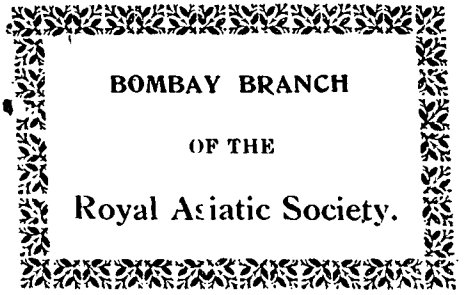
00059947

NOT TO BE ISSUED
OUT OF THE LIBRARY.



Digitized with financial assistance from the
Government of Maharashtra
on 17 February, 2016

COMTE'S

PHILOSOPHY OF THE SCIENCES:

BEING AN

EXPOSITION OF THE PRINCIPLES

OF THE

59947
ac

COURS DE PHILOSOPHIE POSITIVE

OF

AUGUSTE COMTE.

BY

G. H. LEWES,

AUTHOR OF "THE BIOGRAPHICAL HISTORY OF PHILOSOPHY," ETC.

LONDON:

JOHN G. BOHN, YORK STREET, COVENT GARDEN.

MDCCCLIII.

1853

146.4
Com/Phi
.59947

LONDON
WILSON AND OGILVY,
Skinner Street.

PREFACE.

THE following attempt to popularize the leading ideas of the greatest thinker of modern times consists of Two Parts, differently treated.

The First Part contains the philosophy of the six Preliminary Sciences (Psychology being included for reasons there adduced); the Second Part contains Social Science, including the philosophy of History. In the former there is, besides an exposition of Comte's views, a large admixture of criticism, illustration, new speculation and fact; in the latter I have scarcely added anything, confining myself to an abridgment of his exposition, preserving his own terms, as far as practicable.

The main reason of this difference in treatment lies in the subject itself. It was but just that Comte should be allowed to state in his own way, and without interruption, the principles of a Science he himself created. This consideration did not apply to the other sciences, and in order to make the volume more

attractive, I have, while expounding his principles, brought them to bear upon the *present* state of science; accordingly, instead of the Organic Chemistry and Physiology of 1838, the reader will here find the very latest facts and ideas of 1853.

It is right to add that a considerable portion of the First Part appeared as a series of articles in *The Leader* newspaper from April to August 1852; written amid avocations how numerous, and how conflicting, only friends can know! They have been carefully revised and greatly enlarged; three new sections have been added: one of them propounding a theory of the Passage from the Inorganic to the Organic, the importance of which demands, indeed, far more exhaustive treatment than is there given; but as it seems hopeless for me to expect the requisite leisure, I send the theory forth to meet with whatever acceptance its real value will procure.

One word in conclusion respecting the remark made by Sir WILLIAM HAMILTON, and quoted by Mr. MORELL in his *Philosophic Tendencies of the Age*, to the effect that it is somewhat surprising Comte should begin to be taken up in England just as he is being given up in France. The intended inference is obvious; unfortunately, the fact is altogether erroneous. So far from his reputation declining in France, it is now beginning to assume importance, not only by the increase of disciples, but by the adhesion of eminent men. From the very nature of his philosophy, it could only

hope for an early acceptance among those men of science whose preliminary studies in some sort qualified them to receive it—namely, the Physiologists. Accordingly, while jealous metaphysicians and narrow mathematicians are angry and contemptuous in speaking of him, he now counts among his French disciples Dr. LITTRÉ, the physiologist, and his first eminent coadjutor,—Dr. CHARLES ROBIN, perhaps the most distinguished living French anatomist, and the worthy successor to BICHAT,—Dr. VERDEIL, the organic chemist, —Dr. SEGOND, the physiologist,—and J. B. BÉRAUD, whose admirable *Manuel de Physiologie* appeared while these sheets were passing through the press. As to the mass of his readers, it is enough to say that the *Philosophie Positive* is out of print, and his other works are published at prices so moderate that a large sale must be calculated on,—which does not look like a waning reputation.

But after all, a system of philosophy is supremely independent of its temporary acceptance, or rejection, in France, or elsewhere; our question is simply: Is it true?

If the following pages enable a conscientious answer to be given to this question their purpose is fulfilled.

G. H. LEWES.

Kensington, Sept. 1853.

CONTENTS

PAGE

Biographical Introduction 1

PART I. FUNDAMENTAL SCIENCES.

SECTION I.
General Considerations on the Aim and Scope of Positivism . 8

SECTION II.
What is Philosophy? 18

SECTION III.
The Fundamental Law of Evolution 26

SECTION IV.
Classification of the Sciences 40

SECTION V.
What are the Laws of Nature? 51

SECTION VI.
Philosophical Considerations on the Mathematical Sciences . 58

SECTION VII.
General Considerations on Astronomy 75

SECTION VIII.
Astronomy and Religion 84

SECTION IX.
The Scope and Bearing of Physics 93

SECTION X.
On the Influence and Method of Physics 101

SECTION XI.
General Considerations on Chemistry 113

SECTION XII.
Position and Method of Chemistry 121

SECTION XIII.
Organic Chemistry 132

SECTION XIV.
The Passage from the Inorganic to the Organic 142

SECTION XV.
The Science of Life 163

SECTION XVI.
Scope and Method of Biology 173

PAGE

SECTION XVII.

Philosophic Anatomy 180

SECTION XVIII.

Vital Dynamics 190

SECTION XIX.

Vital Dynamics: Materialism or Immaterialism? . . . 198

SECTION XX.

Vital Dynamics: Instinct and Intelligence 206

SECTION XXI.

Psychology: a New Cerebral Theory 218

PART II. SOCIAL SCIENCE.

SECTION I.

The Three Reigning Doctrines 233

SECTION II.

Attempts to Create a Doctrine 243

SECTION III.

General Spirit of Sociology 249

SECTION IV.

Social Statics: Method and Elements 256

SECTION V.

Social Dynamics 268

SECTION VI.

Ages of Fetichism and Polytheism 273

SECTION VII.

Catholicism: Middle Ages 288

SECTION VIII.

The Transition Age 300

SECTION IX.

Rise of the Industrial Order 305

SECTION X.

Æsthetic, Scientific, and Philosophic Evolution 313

SECTION XI.

The French Revolution 322

SECTION XII.

The Future 327
Conclusion 340

COMTE'S

PHILOSOPHY OF THE SCIENCES.

BIOGRAPHICAL INTRODUCTION.

At the close of the *Biographical History of Philosophy*, after having traversed the great epochs of speculation, I endeavoured, by a few rapid touches, to sketch the position occupied by Auguste Comte, the greatest thinker of modern times,—the man whose doctrine is to the nineteenth century something more than that which Bacon's was to the seventeenth and eighteenth centuries. Imperfect and meagre as that sketch necessarily was, confined within the narrow limits of a concluding chapter, it has not been without its effect in leading to a more intimate study of Comte; and one may hope that a considerable public may be found eager to hear a more ample and more detailed description of the Positive Philosophy. A long cherished intention to do this in some shape or other is now at last to be gratified. It is one of our noble human instincts that we cannot feel within us the glory and the power of a real conviction without earnestly striving to make that conviction pass into other minds. All propagandé is

religious; all steadfast preaching of the truth, such as our minds decree it, is a human duty, a social instinct. Otherwise, why ruffle the complacency of fools by demonstrating their absurdities? Why draw upon oneself the harsh names and harsher constructions, the scorn and bitterness, of those from whom we differ? I owe too much to the influence of Auguste Comte, guiding me through the toilsome active years, and giving the sustaining Faith which previous speculation had scattered, not to desire that others should likewise participate in it. For ten years it has been with me, surviving all changes of opinion, and modifying my whole mental history; and my debt of gratitude is inexpressible in words. If, after this recognition, I shall be found dissenting from some opinions energetically maintained by Comte and his unhesitating disciples, it is only necessary to remind the reader that reverence is not incompatible with independence.

Auguste Comte was born in 1797. His family was eminently catholic and monarchical—a detail not without its significance in considering his philosophic education. His collegiate education commenced in one of those institutions wherein Bonaparte vainly endeavoured to restore the antique preponderance of the theologico-metaphysical régime. It was at college, in his quick and eager youth, that Bacon rose up in scorn against the scholastic course of study, and planned the first sketch of the *Novum Organum*. It was at college that Descartes became painfully conscious of the incompetence of the Aristotelian method, and the vanity of the reigning sciences. It was at college that Locke grew impatient of the quibbling pedantries which passed current as philosophy, and learned to despise all education except self-education. So also it was at college that Comte first felt the necessity of an entire renovation of philosophy; and, impressed with the conviction that the restriction of the scientific Method to the phenomena of the inorganic

"world was an absurdity, he saw thus early the absolute necessity of applying that Method to vital and social problems. Bacon was thirteen, Comte fourteen, when this reforming spirit awoke in each.

He was still in this condition of mind when he became acquainted with the celebrated St. Simon, and worked under him as one of his most active disciples. In after-life he characterised St. Simon as "a very ingenious but very superficial writer, whose nature, more active than speculative, was assuredly not very philosophic, and was really moved by nothing but an immense personal ambition." The coincidence in their point of view, viz., the necessity of a Social Renovation based upon a Mental Revolution, brought them together; and the charm and personal ascendancy of St. Simon seems to have subjugated Comte, who considers, however, that their intercourse only troubled and interrupted the genuine course of his own speculations, by directing them towards futile attempts at direct political action.

His career was interrupted in another and more painful manner in 1826, when over-work and heart anxieties brought on a cerebral excitement, which, under the care of mad doctors, was fostered into decided insanity. After the doctors had declared him incurable, he was cured by domestic care and tenderness. He has himself boldly stated this episode in his life, in anticipation of the perfidy of antagonists, who would not fail to fling it in derision at him. That this insanity was but a transient cerebral disorder, no reader of his volumes need be told; for whatever opposition his opinions may excite, however false and absurd they may appear, they assuredly have nothing of that extravagance and flightiness to which the imputation of madness can be applied.

His life appears to have been a quiet scientific life, his daily bread earned by teaching mathematics, both in private and at the Ecole Polytechnique, where he was

professor. His leisure was devoted to the slow elaboration of his philosophy. He has told us the story of his persecutions, in the preface to the sixth volume of the *Philosophie Positive;* but, of course, he has only told us *his* view of the matter; and we know that men writing the story of their wrongs are not always the most accurate of historians. That he had offended Arago, and most of his brother professors, is quite clear; and the fact of his gradual dismissal from one post after another is as indisputable as it is deplorable. The reader will learn with pain that Comte, in his fifty-seventh year, is thrown upon the world, with no other resources than such as his friends and admirers can collect for him.

Besides his official teaching, Comte has for many years been accustomed to deliver gratuitous lectures on sections of the positive philosophy, every Sunday, for six months in the year; by this means disseminating among the people general truths of the most important nature. And these avocations may be said to have constituted his life, varied by two constant recreations—Poetry and Music. His writings, which already amount to twelve thick volumes, have been composed with a rapidity almost incredible. The whole of the first volume of the *Philosophie Positive* (900 pages) was written in three months! and the rest with a rapidity which will in some measure account for the imperfections of his verbose style. His works are as follows:—

Cours de Philosophie Positive, 6 vols. Paris, 1830—42.

Traité Elémentaire de Géometrie Analytique, 1 vol. Paris, 1843.

Traité d'Astronomie Populaire, 1 vol. Paris, 1845.

Discours sur l'Ensemble du Positivisme, 1 vol. Paris, 1848 (a volume which is reprinted in the following work).

Système de Politique Positive, 4 vols. (two of which only have appeared). Paris, 1851—2.

Catéchisme Positiviste, ou Sommaire Exposition de la Réligion Universelle, 1 vol. Paris, 1852.

There are two grand divisions in his life, corresponding with the two fundamental divisions of his philosophy. The lonely man of science, whose days were passed in meditation and the task-work of tuition, who led a purely intellectual life, was well fitted for the great mission of elaborating a philosophy of the Sciences, and thereby laying the immutable basis of a new Social Doctrine,—in other words, of elaborating a Philosophy as the indispensable preparation for a Religion; but this intellectual life, in proportion as it fitted him for the co-ordination of scientific principles, rendered him unfitted, by its exclusiveness, for that intense and enlarged conception of our emotional life, with which Religion and Morality are inseparably connected. I am touching here upon a characteristic of the Positive Philosophy, which, for a long time to come, will be an obstacle to its acceptance; for men of Science will reject with a sneer the subordination of the Intellect to the Heart,—of Science to Emotion; and the unscientific, feeling the deep and paramount importance of our Moral Nature, will be repelled from a philosophy which rests solely upon a scientific basis. Logic and Sentiment—to use popular generalizations—have long been at war, and men reject Comte's system, because it seeks to unite them.

That the Intellectual aspect is *not* the noblest aspect of man, is a heresy which I have long iterated with the constancy due to a conviction. There never will be a Philosophy capable of satisfying the demands of Humanity, until the truth be recognised that man is moved by his emotions, not by his ideas: using his Intellect only as an eye to *see the way*. In other words, the Intellect is the servant, not the lord of the Heart; and Science is

a futile, frivolous pursuit, unworthy of greater respect than a game of chess, unless it subserve some grand religious aim,—unless its issue be in some enlarged conception of man's life and destiny! I say this without much fear of being misunderstood. My opinions on religion have been too often, and too unequivocally pronounced, to admit of the supposition, that in thus placing Science in subordination to Religion, there is any wish to countenance the current declarations of orthodoxy. I agree with the *spirit* of those declarations, while totally disagreeing with the opinions they imply. Although I do not owe to Auguste Comte the conviction of moral supremacy, I have been greatly strengthened in the conviction by observing its growth in his mind.

At the age of forty-five, Comte fell in love with an unhappy and remarkable woman, separated from her husband. One whole year of chaste and exquisite affection changed his life. He had completed his great work on *Positive Philosophy*. His scientific elaboration was over. He was now to enter upon the great problems of Social Life; and by a fortunate coincidence, it was at this moment that he fell in love. It was then this Philosopher was to *feel* in all its intensity the truth which he before had perceived,—viz., that in the mass, as in the individual, predominance is due to the affections, because the intellect is really no more than the servant of the affections. A new influence, penetrating like sunshine into the very depths of his being, awakened there the feelings dormant since childhood, and by *their* light he saw the world under new aspects. He grew religious. He learned to appreciate the abiding and universal influence of the affections. He gained a new glimpse into man's destiny. He aspired to become the founder of a new religion—the religion of Humanity.

For one long blissful year, Auguste Comte knew the inexpressible happiness of a profound attachment; and

"then the consolation of his life was withdrawn from him —the angel who had appeared to him in his solitude, opening the gates of heaven to his eager gaze, vanished again, and left him once more to his loneliness; but, although her presence was no longer there, a trace of luminous glory left behind in the heart of the bereaved man, sufficed to make him bear his burden, and dedicate his days to that great mission which her love had sanctified.

SECTION I.

GENERAL CONSIDERATIONS ON THE AIM AND SCOPE OF POSITIVISM.

THERE is one very injurious, though very intelligible mistake current on the subject of the Positive Philosophy. It is supposed to be a thing of dry, severe science, only interesting to scientific men—presenting only the scientific aspect of things, and leaving untouched the great questions of Emotion, of Art, of Morality, of Religion; a philosophy which may amuse the intellect of the speculative few, but can never claim the submission of the mass. The mistake is injurious, because the thinking world happens, unfortunately, to be divided into two classes—men of science destitute of a philosophy, because incompetent for the most part to the thorough grasp of those generalities which form a philosophy; and metaphysicians, whose tendency towards generalities causes them to disdain the creeping specialities of physical science. Thus, between Science which ignores Philosophy, and Philosophy which ignores Science, Comte is in danger of being set aside altogether. These pages will probably convince the reader, that the Positive Philosophy must necessarily reconcile these discrepancies, and that, while rendering due recognition to the specialities of experimentalists, it gives full scope to the generalizing tendency of philosophers. Meanwhile, the moralist, the metaphysician, and the man of letters, may be assured, that if Comte's system has one capital distinction more remarkable than another, it is the absolute

predominance of the moral point of view—the rigorous subordination of the intellect to the heart. Speculation, as a mere display of intellectual energy, it denounces; science, as commonly understood, it looks upon with something of the feeling which may move the moralist contemplating the routine of pin-makers. The half-repugnant feeling about science, in the minds of literary men, artists, and moralists, is a natural and proper insurgence of the emotions against the domineering tendency of the intellect: men know that the moral life is larger and more intense than the intellectual life—they know that this moral life has its needs, which no science can pretend to regulate, and they reject a philosophy which speaks to them only of the Laboratory. But in Comte, Science has no such position. It is the basis upon which the social superstructure may be raised. It gives Philosophy materials and a Method; that is all.

If the Positive Philosophy be anything, it is a doctrine capable of embracing all that can regulate Humanity; not a treatise on physical science, not a treatise on social science, but a system which absorbs all intellectual activity. "Positivism," he says, in his recent work, "is essentially composed of a Philosophy and a Polity, which are necessarily inseparable because they constitute the basis and aim of a system wherein intellect and sociability are intimately connected." And farther on, "This then is the mission of Positivism: to generalize science, and to systematize sociality." In other words, it aims at creating a Philosophy of the Sciences as a basis for a new social faith. A social doctrine is the *aim* of Positivism, a scientific doctrine the *means*; just as in man, intelligence is the minister and interpreter of life. "En effet, si le cœur doit toujours poser les questions, c'est toujours à l'esprit qu'il appartient de les résoudre."

So much for the aim. Let me now call attention to Comte's initial conceptions; and first, to the luminous

conception of *all the sciences—physical and social—as branches of one Science, to be investigated on one and the same Method.*

To say that Science is one, and that the Method should be one, may, to the hasty reader, seem more like a truism than a discovery; but on inquiry he will find, that before Comte, although a general idea of the connection of the physical sciences was prevalent, yet, to judge from Mrs. Somerville's work, or Herschel's *Discourse*, it was neither very precise nor very profound; no one had thought of a Social Science issuing from the Physical Sciences, and *investigated on the same method.* In fact, to talk of moral questions being reduced to a positive science will even now be generally regarded as absurd. Men use the phrase "Social Science," "Ethical Science," but they never mean thereby that Ethics forms one branch of the great tree, rising higher than the physical sciences, but rising from the *same* root. On the contrary, they interpret ethical phenomena by metaphysical or theological methods, and believe History to be under the governance not of Laws, but of caprice.

The second initial conception which the reader should familiarize his mind with, is that of the fundamental Law of human development:—*There are but three phases of intellectual evolution—for the individual as well as for the mass—the Theological* (*Supernatural*), *the Metaphysical, and the Positive.*

Hereafter this law will be illustrated in detail, and a very brief indication will be sufficient now. In the *Supernatural* phase the mind seeks *causes;* it aspires to know the *essences* of things, and the How and Why of their operation. It regards all effects as the productions of supernatural agents. Unusual phenomena are interpreted as the signs of the pleasure or displeasure of some god. In the *Metaphysical* phase, a modification takes place; the supernatural agents are set aside for

abstract forces or Entities supposed to inhere in various substances, and capable of engendering phenomena. In the *Positive* phase the mind, convinced of the futility of all inquiry into *causes* and *essences*, restricts itself to the observation and classification of phenomena, and to the discovery of the invariable *relations* of succession and similitude which things bear to each other: in a word, to the discovery of the *laws* of phenomena.

The third initial conception is that beautiful classification of the sciences co-ordinated by the luminous principle of *commencing with the study of the simplest (most general) phenomena, and proceeding successively to the most complex and particular;* thus arranging the sciences according to their *dependence* on each other.

The three great conceptions just stated no one can be expected to appreciate until he has applied them. But how would he appreciate any general conception—say the law of gravitation—if it were simply presented to him as a formula which he had not verified? Let an honest verification of the three formulas be made, and I have the deepest conviction that no competent mind will fail to recognise them as the grandest contributions to philosophy since Descartes and Bacon inaugurated the positive method.

And now a word on the part Positivism is to play in the coming years of struggle. That a new epoch is dawning, that a new form of social life is growing up out of the ruins of feudalism, the most superficial observer cannot fail to see; and as signs of the deep unrest now agitating society, no less than as evidence of the indestructible aspiration after an Ideal which has always moved mankind, the systems of Communism so confidently promulgated attract the attention of most thinkers. But can any system of Communism yet devised be accepted as an efficient solution of the social problem? Positivism says No; and for this reason: Communism is simply a *political* solution of a problem which

embraces far deeper and higher questions than politics. Communism is the *goal* towards which society tends, not a *path* by which the goal may be reached. Neither cooperation, nor watchwords of fraternity, however sincerely translated into action, can pretend to compass the whole problem. For let us suppose the political questions settled; let us imagine a parallelogram of harmonious success — a human bee-hive of cooperative activity,—will *all* be settled then? Will not the deep and urgent questions of Religion and Philosophy still demand an answer? Just where man most obviously rises above the bee, Communism leaves him to the care of Priests and Teachers, who cannot agree among themselves! and as all polity is founded on a system of ideas believed in common, as we cannot in social problems isolate the political from the moral, the moral from the religious system, Communism leaves society to its anarchy.

The present anarchy of politics arises from the anarchy of ideas. The ancient faiths are shaken where they are not shattered. The new faith which must replace them is still to come. What Europe wants is a Doctrine which will embrace the whole system of our conceptions, which will satisfactorily answer the questions of Science, Life, and Religion; teaching us our relations to the World, to Duty, and to God. A mere glance at the present state of Europe will detect the want of *unity*, caused by the absence of any one Doctrine *general* enough to embrace the variety of questions, and *positive* enough to carry with it irresistible conviction. This last reservation is made because Catholicism has the requisite *generality*, but fails in convincing Protestants. The existence of *sects* is enough to prove, if proof were needed, that none of the Religions are competent to their mission of *binding together* all men under one faith. As with religion, so with philosophy: no one doctrine is universal; there are almost as many philosophies as philosophers. The dogmas of Germany are laughed at

in England and Scotland; the psychology of Scotland is scorned in Germany, and neglected in England. Besides these sectarian divisions, we see Religion and Philosophy more or less avowedly opposed to each other.

This, then, is the fact with respect to general doctrines:—Religions are opposed to religions, philosophies are opposed to philosophies; while religion and philosophy are essentially opposed to each other.

In positive Science there is less dissidence, but there is a similar absence of any general Doctrine. Each science rests on a broad firm basis of ascertained truth, and rapidly improves; but a Philosophy of the Sciences is nowhere to be found, except in the pages of Auguste Comte. The *speciality* of most scientific men, and their seeming incapacity of either producing or apprehending general ideas, has long been a matter of just complaint; they are Hodmen, and fancy themselves Architects. This incapacity is one of the reasons why nebulous metaphysics still waste the fine activity of noble minds; men see clearly enough that, however exact each separate science may be, these sciences do not of themselves constitute philosophy: bricks are not a house. In the early days of science, general views were easily attained. As the materials became more complex, various divisions took place; one man devoted himself to one science, another to another. Even then, general ideas were not absent. But, as the tide swept on, discovery succeeding discovery, like advancing waves, new tracks of inquiry opening vast wildernesses of undiscovered truth, it became absolutely necessary for one man to devote the labour of a life to some small fraction of a science, leaving to others the task of ranging his discoveries under their general head. The result has been, that most men of science regard only their speciality, and leave to metaphysicians the task of constructing a general doctrine. Hence we find at present abundance of ideas powerless, because they are not posi-

tive; and the positive sciences powerless, because they are not general. The aim of Comte is to present a doctrine *positive*, because elaborated from positive science, and yet possessing all the desired *generality* of metaphysical schemes, without their vagueness, baselessness, and inapplicability.

Some remarks from Comte's introductory lecture may now be quoted.

"It is not, I believe, to the readers of this work that I require to prove that ideas govern the world, maintain it in order, and throw it into anarchy; or, in other words, that the whole social mechanism is based ultimately upon opinions. They well know that the present great political and moral crisis in society really depends, at bottom, on our intellectual anarchy. Our greatest evil, indeed, consists in the profound divergence existing among all minds in relation to every fundamental maxim, fixity in which is the principal condition of all social order. So long as individual minds do not adhere together from a unanimous agreement upon a certain number of general ideas, capable of forming a common social doctrine, the state of the nations will of necessity remain essentially revolutionary, in spite of all the political palliatives that can be adopted; and will not permit the establishing of any but *provisional* institutions. It is equally certain that, if this union of minds, from a community of principles, can once be obtained, institutions in harmony with it will necessarily arise, without giving room for any serious shock,—that single fact of itself clearing away the greatest disorder. It is, therefore, to this point that the attention of all those who perceive the importance of a truly normal state of things ought principally to be directed.

"Now, from the point of view to which the different considerations noticed in this discourse have by degrees elevated us, it is easy at once to characterize the present state of society with precision and to its inmost centre,

and at the same time to deduce the means by which we can effect an essential change upon it. By means of the all-important law enounced at the beginning of this discourse, I believe I can exactly sum up all the observations made upon the present condition of society, by simply saying that the present intellectual anarchy depends, at bottom, *on the simultaneous employment of three philosophies radically incompatible: the theological, the metaphysical, and the positive.* It is in fact clear, that if any one of those three philosophies really obtained an universal and complete preponderance, there would be a determinate social order, whereas our especial evil consists in the absence of all true organization whatever. It is the co-existence of the three antagonistic philosophies that absolutely prevents a mutual understanding upon any essential question. Now, if this view is correct, we have only to ascertain which of the three philosophies can, and, from the nature of things, must prevail; every man of sense will then feel obliged to concur in its triumph, whatever his own peculiar opinions may have been before the question was thoroughly analyzed and settled. The inquiry being at once reduced to this simple footing, it plainly cannot remain for any length of time indeterminate; since it is evident, from various reasons, that the positive philosophy is alone destined to prevail, according to the ordinary course of things. It alone, for a long series of ages, has been making progress, while its antagonists have constantly been in a state of decline; rightly or wrongly,—it matters not: the general fact is incontestable, and that is enough."

Surely no one will question this fact of scientific progress, concurrent with the decline of Religious and Metaphysical systems? If he do question it, let him refer to the ample proofs furnished by Comte; and, as regards Metaphysics, to the *Biographical History of*

Philosophy. This unequivocal proclamation of history must not be disregarded; to that which Humanity has persisted in through the long course of centuries let no man shut his eyes!

These general considerations cannot be better concluded than by giving Comte's views of education.

"The establishment of the Positive Philosophy will be the presiding and influencing agent in the general reconstruction of our system of Education. Already, indeed, all enlightened minds unanimously recognise the necessity of discarding our European system of education, which is still essentially theological, metaphysical, and literary, and substituting for it a positive education in harmony with the spirit of the age, and suited to the wants of modern civilization. The spontaneous conviction of this necessity has been everywhere extending itself, as we see from the varied and ever increasing attempts, for a century, and particularly of late, to diffuse positive instruction, and to augment it without limit. The different governments of Europe have always zealously joined in these efforts, when they did not happen to originate them. But while we further these useful undertakings, as far as possible, we must not conceal the fact that, in the present state of our ideas, they are utterly powerless to effect their chief object,—namely, the radical regeneration of general education. For, the exclusive speciality and too marked absence of any bond of connection, which continue to characterise our mode of regarding and cultivating the sciences, must of necessity greatly affect the manner of expounding them in our course of education. If an intelligent person at the present day studies the principal branches of natural philosophy, in order to form a general system of positive ideas, he is obliged to study each of them separately, after the same method, and in the same detail, as if his object specially were to become an astronomer, or a

chemist, &c. Hence such an education is almost impossible, and necessarily imperfect, even where the intellect of the student is of the highest order, and his position, otherwise, the most favourable; and it would be altogether a chimerical proceeding, for people going through a general course of education, to attempt studying the sciences in this detailed way. And yet a general education absolutely requires an *ensemble* of positive conceptions upon all the great elements of natural phenomena. It is an *ensemble* of this sort, on a scale more or less extensive, that must henceforth become, even among the popular masses, the permanent basis of all human combinations; that must, in a word, give the general tone to the minds of our posterity. In order that natural philosophy may complete the regeneration of our intellectual system, already so far in progress, it is indispensable that its different constituent sciences (exhibited to every mind as the diverse branches of a single trunk) be, in the first place, reduced to that in which their general features consist,—namely, to their principal methods and to their most important results. It is only in this way that instruction in the sciences can become among us the basis of a new and truly rational general education. And there can be no doubt that, to this fundamental course of instruction, there will be added the different special scientific studies, answering to the different special courses of education which have to succeed the general course. But the essential consideration which I wished to point out here, lies in this, that all these specialities, the accumulation of great labour, would necessarily be insufficient for thoroughly renovating our system of education, if they did not rest on the preliminary basis of this general course of instruction, itself the direct result of the positive philosophy as defined in this discourse."

SECTION II.

WHAT IS PHILOSOPHY?

We shall find some obscurities cleared up, if we can master an accurate and comprehensive definition of philosophy. The definition I have finally settled upon is this:—*Philosophy is the Explanation of the Phenomena of the Universe.* By the term Explanation, the subject is restricted to the domain of the Intellect, and is thereby demarcated from Religion, though not from Theology. The definition not only seems to me a plain expression of the precise nature of Philosophy, but thereby serves to rid us of the perplexities arising from the opposition between Metaphysics and Science, which are thus shown to be nothing more than different methods of reaching the same end. To wrest its secret from the Universe, and to understand our relations to external Nature and to Man, is equally the object of Metaphysical as of Positive inquiry; but the Metaphysician believes he can penetrate into the *causes* and *essences* of the phenomena around him, while the Positivist, recognising his incompetency, limits his efforts to the ascertainment of the *laws* which regulate the succession of these phenomena.

Philosophy is inherent in man's nature. It is not a caprice, it is not a plaything,—it is a necessity; for our life is a mystery, surrounded with mysteries: we live encompassed by wonder. The myriad aspects of Nature *without*, the strange fluctuations of feeling *within*, all demand from us an explanation. Standing upon this ball of earth, so infinite to *us*, so trivial in the infinitude of the Universe, we look forth into Nature with reverent

awe, with irrepressible curiosity. We must have explanations. And thus it is that philosophy, in some rude shape, is a visible effort in every condition of the history of man,—in the rudest phase of half-developed capacity, and in the highest conditions of culture: it is found among the sugar-canes of the West Indies, and in the tangled pathless forests of America. Take man where you will—hunting the buffalo on the prairies, or immoveable in meditation on the hot banks of the Ganges,—priest or peasant, soldier or student, he never escapes from the pressure of the burden of that mystery which forces him to seek, and readily to accept, some explanation of it. The savage, startled by the muttering of distant thunder, asks, "What is that?" and is restless till he knows, or fancies he knows. If told it is the voice of a wrathful demon, that is enough: the explanation is given. If he then be told that to propitiate the demon the sacrifice of some human being is necessary,—his slave, his enemy, his friend, perhaps even his child, falls a victim to the credulous terror. The childhood of man enables us to retrace the infancy of nations. No one can live with children without being struck by their restless questioning, and unquenchable desire to have everything explained, no less than by the facility with which every authoritative assertion is accepted as an explanation. The History of Philosophy is the story of man's successive attempts to explain the phenomena around and within him.

The first explanations were naturally enough drawn from analogies furnished by consciousness. Men saw around them activity, change, force; they felt within them a mysterious power, which made them active, changing, potent: they explained what they *saw*, by what they *felt*. Hence the fetichism of barbarians, the mythologies of more advanced races. Oreads and Nymphs, Demons and Beneficent Powers, moved among the ceaseless activities of Nature. Man knows that in

his anger he storms, shouts, destroys: what, then, is thunder but the anger of some mighty invisible being? Moreover, man knows that if his enemy offer him a *present* it will assuage his anger, and, therefore, it is but natural he should believe the offended thunderer will also be appeased by some offering. As soon as another conception of the nature of thunder has been elaborated by observation and study of its phenomena, the supposed deity vanishes, and, with it, all the false conceptions it originated, till, at last, Science takes a rod, and draws the terrible lightning from the heavens, rendering it so harmless that it will not tear away a spider's web!

But long centuries of patient observation and impatient guessing, controlled by logic, were necessary before such changes could take place. The development of Philosophy, like the development of organic life, has been through the slow additions of thousands upon thousands of years; for Humanity is a growth, as our globe is, and the laws of its growth are still to be discovered.

One of the great fundamental laws has been discovered by Auguste Comte. Before proceeding to expound it, however, it may not be out of place to inquire whether any law of intellectual evolution can be regarded as a fitting exponent of the evolution of Humanity,—in other words, whether the various conditions of social existence are dependent on, or correspond with, conditions of scientific development? This has been so luminously stated by John Stuart Mill, in the sixth book of his *Logic*, that I shall borrow the whole passage.

"In order to obtain better empirical laws, we must not rest satisfied with noting the progressive changes which manifest themselves in the separate elements of society, and in which nothing is indicated but the relation of the fragments of the effect to corresponding fragments of the cause. It is necessary to combine the

statical view of social phenomena with the dynamical, considering not only the progressive changes of the different elements, but the contemporaneous condition of each; and thus obtain empirically the law of correspondence not only between the simultaneous states, but between the simultaneous changes, of those elements. This law of correspondence it is, which, after being duly verified *à priori*, will become the real scientific derivative law of the development of humanity and human affairs.

"In the difficult process of observation and comparison which is here required, it would evidently be a very great assistance if it should happen to be the fact that some one element in the complex existence of social man is pre-eminent over all others as the prime agent of the social movement. For we could then take the progress of that one element as the central chain, to each successive link of which, the corresponding links of all the other progressions being appended, the succession of the facts would by this alone be presented in a kind of spontaneous order, far more nearly approaching to the real order of their filiation than could be obtained by any other merely empirical progress.

"Now, the evidence of history and the evidence of human nature combine, by a most striking instance of consilience, to show that there really is one social element which is thus predominant, and almost paramount, among the agents of the social progression. This is, the state of the speculative faculties of mankind; including the nature of the speculative beliefs, which by any means they have arrived at, concerning themselves and the world by which they are surrounded.

"It would be a great error, and one very little likely to be committed, to assert that speculation, intellectual activity, the pursuit of truth, is among the more powerful propensities of human nature, or fills a large place in the lives of any, save decidedly exceptional individuals.

But notwithstanding the relative weakness of this principle among other sociological agents, its influence is the main determining cause of the social progress; all the other dispositions of our nature which contribute to that progress being dependent upon it for the means of accomplishing their share of the work. Thus (to take the most obvious case first,) the impelling force to most of the improvements effected in the arts of life is the desire of increased material comfort; but as we can only act upon external objects in proportion to our knowledge of them, the state of knowledge at any time is the impassable limit of the industrial improvements possible at that time; and the progress of industry must follow, and depend upon, the progress of knowledge. The same thing may be shown to be truth, though it is not quite so obvious, of the progress of the fine arts. Further, as the strongest propensities of human nature (being the purely selfish ones, and those of a sympathetic character which partake most of the nature of selfishness) evidently tend in themselves to disunite mankind, not to unite them,—to make them rivals, not confederates; social existence is only possible by a disciplining of those more powerful propensities, which consists in subordinating them to a common system of opinions. The degree of this subordination is the measure of the completeness of the social union, and the nature of the common opinions determines its kind. But in order that mankind should conform their actions to any set of opinions, these opinions must exist, must be believed by them. And thus, the state of the speculative faculties, the character of the propositions assented to by the intellect, essentially determines the moral and political state of the community, as we have already seen that it determines the physical.

"These conclusions, deduced from the laws of human nature, are in entire accordance with the general facts of history. Every considerable change historically

known to us in the condition of any portion of mankind, has been preceded by a change, of proportional extent, in the state of their knowledge, or in their prevalent beliefs. As between any given state of speculation, and the correlative state of everything else, it was almost always the former which first showed itself; though the effects, no doubt, reacted potently upon the cause. Every considerable advance in material civilization has been preceded by an advance in knowledge; and when any great social change has come to pass, a great change in the opinions and modes of thinking of society had taken place shortly before. Polytheism, Judaism, Christianity, Protestantism, the negative philosophy of modern Europe, and its positive science—each of these has been a primary agent in making society what it was at each successive period, while society was but secondarily instrumental in making *them*, each of them (so far as causes can be assigned for its existence) being mainly an emanation not from the practical life of the period, but from the state of belief and thought during some time previous. The weakness of the speculative propensity has not, therefore, prevented the progress of speculation from governing that of society at large; it has only, and too often, prevented progress altogether, where the intellectual progression has come to an early stand for want of sufficiently favourable circumstances.

"From this accumulated evidence, we are justified in concluding, that the order of human progression in all respects will be a corollary deducible from the order of progression in the intellectual convictions of mankind; that is, from the law of the successive transformations of religion and science."

Assuming it proved, as history will warrant, that the evolutions of Humanity correspond with the evolutions of Thought—that Science is the torch whereby we see our way—the importance of the fundamental law discovered by Comte cannot easily be exaggerated. It is to

Social Science what Newton's great discovery was to Physics. To make the reader fairly master its significance, I will, in the next section, illustrate the law by familiar examples.

This section may be closed with a digression on the subject of atheism, which many writers attribute to Comte. The charge is a mistake. Comte certainly, by more than one passage, leads an incautious reader, dipping here and there, to suppose him an atheist; but no truthful-minded man could read Comte's works with that attention all serious works demand, and not be strongly impressed by the forcible and scornful rejection of atheism so often there recurring. He regards atheism as the dregs of the metaphysical period, and his scorn for metaphysics is incessant. A passage from his *Discourse on the Ensemble of Positivism*, to all who know his unequivocal outspeaking, will be sufficient:—

"Although I have long formally rejected all solidarity —dogmatic no less than historic—between positivism and what is called atheism, I will here indicate a few summary points of view. Even considered under the purely intellectual aspect, atheism only constitutes a very imperfect emancipation, since it tends to prolong indefinitely the metaphysical stage by its ceaseless pursuit of new solutions of theological problems, instead of pushing aside all such problems as essentially *inaccessible*. The true positive spirit consists in always substituting the study of *laws* for that of *causes*—the *how* for the *why*. It is, therefore, incompatible with the ambitious dreams of a misty atheism relative to the formation of the universe, the origin of animals, &c. Positivism, in its appreciation of our diverse stages of speculation, does not hesitate to declare these doctoral chimeras very inferior — even in rationality—to the spontaneous beliefs of mankind. For the principle of all theology consisting in explaining phenomena by the intervention of a *will*, it can only be set aside by the

recognition of the truth that *causes* are inaccessible, and by the study of the *laws*. So long as we persist in solving the problems of our infancy, it is idle to reject the *naïve* method which our young imagination applied to them, and which alone suit their nature. . . . . *Atheists may therefore be regarded as the most illogical of theologians*, since they attempt the theological problems while rejecting the only suitable method."

That passage is surely *explicit* enough, if nothing else. I quote it, less to remove a misconception current in England, than to anticipate the objection of those who, reading that Comte is an atheist, would ask me what I meant by saying he aspired to the character of founder of a new Religion.

We may now address ourselves to the consideration of his Fundamental Law of Human Evolution.

SECTION III.

THE FUNDAMENTAL LAW OF EVOLUTION.

In the attempts made by man to explain the varied phenomena of the universe, history reveals to us three distinct and characteristic stages, by Comte named the Theological (Supernatural), the Metaphysical, and the Positive.

In the first, man explains phenomena by some fanciful conception suggested by the analogies of his own consciousness.

In the second, he explains phenomena by some *à priori* conception of inherent or superadded *entities*, suggested by the *constancy* observable in phenomena, which constancy leads him to suspect that they are not produced by any *intervention* on the part of an external being, but are owing to the *nature* of the things themselves.

In the third, he explains phenomena by adhering solely to these constancies of succession and co-existence ascertained inductively, and recognised as the *laws* of nature.

It will be seen that the theological stage is the primitive spontaneous exercise of the speculative faculty, proceeding from the known (*i. e.* consciousness) to the unknown. The metaphysical stage is the more matured effort of *reason* to explain things, and is an important modification of the former stage; but its defect is, that it reasons without *proofs*, and reasons upon subjects which transcend human capacity. The positive stage explains phenomena by ascertained laws, laws based on distinct and indisputable certitude gathered in the long

and toilsome investigations of centuries; and these laws are not only shown to be demonstrable to reason, but accordant with *fact;* for the distinguishing characteristic of science is, that it sees and *foresees.* Science is *prevision.* Certainty is its basis and its glory.

In the theological stage, Nature is regarded as the theatre whereon the arbitrary wills and momentary caprices of Superior Powers play their varying and variable parts. Men are startled at unusual occurrences, and explain them by fanciful conceptions. A solar eclipse is understood, and unerringly predicted to a moment, by Positive Science; but in the theological epoch it was believed that some dragon had swallowed the sun! In the metaphysical stage, the notion of capricious divinities is replaced by that of *abstract entities,* whose modes of action are, however, *invariable;* and in this *recognition of invariableness* lies the germ of science. In this epoch, Nature has a "horror of a vacuum;" organized beings have a "vital principle," and matter has a *vis inertiæ.*

In the positive stage, the invariableness of phenomena under similar conditions is recognised as the sum total of human investigation,—beyond the laws which regulate phenomena, it is idle to penetrate.

When men put up prayers for rain or fine weather, they are acting upon the theological conception that these phenomena are not resultants of *invariable laws,* but of some *variable will.* The clergyman refusing to pray for rain "while the wind is in this quarter," naïvely rebukes the impropriety of the request. When men believe that if you "wish for something," on seeing a piebald horse, the wish will be realized—when they believe that if thirteen sit down to dinner, one will die before the year is out—when they believe that if any one be bitten by a dog, he will suffer hydrophobia, should the dog afterwards be attacked by that disease—when they believe that a peculiar conjunction of the stars will

rule their destinies—they are in the theological stage: they conceive Nature as indefinitely variable.

History is crowded with examples of this conception. In poetry, in literature, in daily life, we constantly find traces of this primitive spontaneous mode of conceiving things. To take an illustration:—In the camp of Agamemnon an epidemic breaks out. The men die by scores; but as the dreadful arrows of death are invisible, a terrified army attributes the pestilence to the anger of offended Apollo, who avenges an insult to his priest by this "clanging of the silver bow." This *explanation*, so absurd in our eyes, was acceptable to the facile acquiescence of that epoch; and expiatory peace-offerings were made to the irritated deity, in a case where modern science, with its sanitary commission, would have seen bad drainage or imperfect ventilation! But to prove that the theological stage is not thoroughly and universally passed, we need only refer to the monstrous illustration of our own days, when learned men, the teachers of our people, gravely attributed the cholera to God's anger at England's endowment of the Maynooth Colleges!

There was a church in Sienna which had often been injured by lightning. A conductor was set up, in defiance of the "religious world," wherein it was regarded as "the heretical stake." A storm arose, the lightning struck the tower; crowds flocked to see if the church was spared, and lo! the very spiders' webs upon it were unbroken! Here we see science correcting the mischievous prejudices of theology.

Mythology is poetry to us; to the ancients it was religion and science. The *explanations* given in those days were all drawn from the fundamental conception of Nature as subject to no other laws than those of supernatural agencies. The lowest of the theological periods is that of Fetichism; from that there is a transition to Polytheism; and the highest is Monotheism, wherein

the providential agency of One being is substituted for that of many independent divinities.

The same tendency to look *beyond* the fact for an explanation of the fact—to imagine an agency superadded to the phenomena—is visible in the metaphysical period. The notion of invariableness is admitted, and to explain it some "entity" or "principle" is imagined. Thus Kepler imagined that the regularity of planetary movements was owing to the planets being endowed with *minds* capable of making observations on the sun's apparent diameter, in order to regulate their motions so as to describe areas proportioned to the times. Thus, also, natural philosophers even now continue to repeat the old notions of a *vis inertiæ*, which they talk of "overcoming;" and in chemistry they imagine "affinities," while they laugh at the old notion of a "phlogistic principle." In biology we see the Metaphysical Method still running riot. Aristotle may, historically, be admired for his conception of "animating principles" (ψυχαι), which caused the vital actions of animals and plants—principles which had a sort of hierarchy among themselves, under a supreme controlling agent (φυσις); but while the historian of science will award the praise due to such a theory in the series of progressive conceptions, he must with wonder, not unmingled with contempt, record that a philosopher of considerable repute (Dr. Prout) has in this nineteenth century revived that conception in all the plenitude of its absurdity. Dr. Prout assumes the existence of *organic agents*, whose office it is to produce and regulate vital phenomena, "distinct *intelligent* agents," all under one hierarchy, "each possessing more or less control over all the agents below itself, and having the power of appropriating their services, till at length, in the combined operation of the whole series of agents at the top of the scale, we reach the perfection of organic existence." That such a notion has not been met by shouts of laughter, shows how dimly the

Positive Method is conceived even by men of positive science!

As a striking and useful example of this metaphysical method, let us consider the widely spread belief in a *vis medicatrix naturæ*, or, as the vulgar express it, "Nature the best physician." Not only the vulgar, but renowned men of science, believe that the process of reparation which is observed in the organism—the power which ejects noxious ingredients from the system—the "conservative powers," in short—are owing to some "tendency," or "principle," which they set down to the credit of "Nature;" forgetting that if the restoration of the torn tissue or broken limb be attributed to a *vis medicatrix*, or "curative principle," death by poison must then be attributed to a "poisoning principle." An exhalation from an uncovered drain or stagnant pool enters the blood through the active agency of the lungs. What does Nature? Does she resist this disturbing influence—eject this noxious ingredient? Not she! she pumps away as if the poison were the most beneficent of visitors, and distributes it throughout the organism with the same impartiality as she distributes the health-giving oxygen. On the metaphysical method, we must suppose some "principle" at work here. What shall we call it? The *vis deletrix*—the "destructive principle?" Physiologists—especially those who indulge in natural theology—explain to you the "beneficent intention" of the digestive apparatus; but they omit to add, that if, instead of mutton, you introduce arsenic, watchful Nature does *not* commence an antiperistaltic action, and eject the poison, but absorbs it as actively as if it were pregnant with nutriment: the *vis deletrix* is at work! An insect settles in some part of your body; takes up its abode there, and begins to make itself comfortable by feeding on the body. Does Nature, by her *vis medicatrix*, expel the intruder? Does a cheese expel the maggot? Nature cherishes the parasitic fungus,

feeds and fosters it with tender care, makes much of it, nourishes its vitality with the vitality of your body; and so tendered, the fungus grows and grows till you are destroyed; and you—who perhaps may be a Shakspeare, a Goethe, a Bacon, a man of quite infinite value to Humanity—are sacrificed to a fungus!

In truth, Nature is neither Physician nor Assassin; and it is only our vain efforts to discover her "intentions" that make her appear such. Our province is to study her laws, to trace her processes, and, thankful that we can so far penetrate the divine significance of the universe, be content—as Locke wisely and modestly says—to sit down in quiet ignorance of all *transcendent* subjects.

In the final and Positive stage, men accept Nature as she presents herself, without seeking beyond the facts for fantastic entities. "It was formerly believed," says Oersted, "that basilisks existed in cellars which had been long closed; they were invisible, but their look killed whoever it fell upon. Since it is become more generally known that fermentation is produced by a noxious air, whose weight causes it to accumulate in low places, we recognise the destructive agent, and drive it away by means of fresh air." There you have an example of the two conceptions, metaphysical and positive: the one seeking its explanation in an unknown entity (basilisk), the other in known laws of Nature's processes. History shows us the gradual dispersion of superstitions and fantastic creeds before the light of *certainty* which Science carries everywhere.

The history of any science will furnish examples of the three Methods, and Comte, in the course of his work, has given several: let me add one from *Teratology*, or the "Science of Monstrosities,"—a science only possible within the last century, since the discoveries of Geoffroy St. Hilaire.

At first, when an unhappy mother brought forth one

of those "organic deviations" we name "monsters,"—such, for example, as a child with two heads, or a child with no head, the ready explanation was, that such a monster came as a "token of God's anger;" sometimes it was said that the devil had seduced or violated the mother, and this monster was the result! Here we have the spontaneous explanation suggested by the Theological spirit. In later times, this explanation was relinquished as ridiculous. It was then believed,—as, indeed, it is still very generally believed,—that the acorn *contained* the oak, and the germ *contained* the man. This Metaphysical conception of primitive germs, *potentially* containing all that may subsequently be developed from them, naturally led men to argue that a monster was *originally* a monster—that the deformation existed potentially in the primitive germ—and the curious student who may consult the works of Serres and Isidore Geoffroy St. Hilaire will find many of the ingenious arguments which have been from time to time advanced in favour of the primitive deformity of the germ.* The third or Positive conception of Epigenesis, or gradual organic development in accordance with conditions, has finally routed the metaphysical conception of "pre-existent germs;" and by considering monsters as simple cases of "organic deviation," has, with the aid of Geoffroy St. Hilaire's great law of "arrested development," made monstrosity a branch of positive embryology.

Thus we have God's anger, or the devil's lust, representing the Theological spirit; *Potential* pre-existent germs, representing the Metaphysical spirit; and, finally, "Arrest of development," representing the Positive spirit.

Having multiplied examples from Science, let me close

* Serres, *Organogénie* and *Anatomie Transcendante;* Isidore Geoffroy St. Hilaire, *Histoire des Anomalies de l'Organization.*

these illustrations by one from Politics. So completely are men in the Theological and Metaphysical stages, with respect to the Science of Society, that, ignoring all laws and conditions of growth and development, they almost universally believe in the absurd notion of a political *change* being wrought by an alteration in the Government, or by the adoption of some scheme. For example, they believe that to make society republican, we must adopt the forms of a Republic; not seeing that when these forms of government are *given* to a nation, instead of *growing out* of the national tendencies and ideas, they are merely new names given to old realities. The belief is a remnant of the old theological, *mechanical* conception, which supposes man to be external to the social organism, instead of being an integral portion of it. We must replace this mechanical by a dynamical conception, and understand that the social organism has its laws of growth and development, like the human organism.

And here let me illustrate Comte's fundamental Law of Evolution by an analogy taken from the human organism. To do this, it will be necessary first to explain one of the laws of Embryology:

Every function is successively executed by two (sometimes more) organs: of which one is primitive, transitory, provisional; the other, secondary, definitive, permanent.

There is always a relation between these two organs, —a relation not only of function, but of development and duration. The *provisional* organ first supplies the place of the permanent organ, then coexists with it, during the earlier phases of the latter's evolution; and, finally, when the permanent organ has acquired due development, the provisional organ either ceases its function altogether, or performs it incompletely. Some of these provisional organs, such as *milk* teeth, and the *down* which is afterwards replaced by hair, separate

themselves from their successors, falling away to make room for them. Others are absorbed, and become diminished to a rudimentary condition or mere zero: such are the *branchiæ*, always present in tadpoles, and now known to coexist with the lungs of many of the higher vertebrata; such, also, are the optic lobes of the brain, at first the principal organs of the encephalon, but which gradually diminish as the cerebral hemispheres develope, and finally present the rudimentary condition observed in the human brain as the corpora quadrigemina; such, also, are the *thymus* gland and the fœtal tail, which disappear, and the renal capsules and thyroid gland, which diminish.

Again, in the development of the embryo we distinguish three forms of circulation entirely different; the first form of circulation is coincident with the formation of the blastoderma and the umbilical vesicle; the second form commences with the first appearance of the allantoid, and development of the placenta; the third form with the development of lungs, intestines, and organs of relation. These three forms, be it observed, are characterized by the creation of new vascular systems, and the atrophy of those which preceded them.

These examples might be multiplied, but it will be enough to sum up the results of embryological research on this point in the two following propositions:—

1. *That everything which is primitive is only provisional,* at least in the higher animals; *and everything that is permanent has only been established secondarily, and sometimes tertiarily.*

2. *That, consequently, the embryo of the higher animals successively renews its organs and its characteristics, through a series of metamorphoses which give it permanent conditions, not only different, but even directly contrary to those which it had primitively.*

Now, among the innumerable striking analogies between the development of the Human and the Social

Organism it seems to me we must place this law of provisional development. The three phases, Theological, Metaphysical, and Positive, through which Humanity *necessarily* passes in its growth, represent the Primitive, Transitory, and Permanent phases of the organism. The analogy is perfect in all its details, and I invite the student to follow out its various applications: he will then arrive at the full conviction of what can only here be indicated,—namely, that the Theological and Metaphysical phases are *provisional* organs in the development of Humanity.

Having, by various examples, endeavoured to popularize the conception of the fundamental law of the three phases through which Humanity passes, I will conclude with some passages of my former exposition of Comte's system, and risk the tediousness of repetition, for the sake of the effect of iteration:—

"All are agreed, in these days, that real knowledge must be founded on the observation of *facts*. Hence contempt of mere theories. But no science could have its origin in simple observation; for if, on the one hand, all positive theories must be founded on observation, so, on the other, it is equally necessary to have some sort of theory before we address ourselves to the task of steady observation. If, in contemplating phenomena, we do not connect them with some principle, it would not only be impossible for us to combine our isolated observations, and consequently to draw any benefit from them; but we should also be unable even to retain them, and most frequently the important facts would remain unperceived. We are consequently forced to theorize. A theory is necessary to observation, and a correct theory to correct observation.

"This double necessity imposed upon the mind—of observation for the formation of a theory, and of a theory for the practice of observation—would have caused it to move in a circle, if nature had not fortunately provided

an outlet in the spontaneous activity of the mind. This activity causes it to begin by assuming a cause, which it seeks out of nature, *i. e.*, supernatural. As man is conscious that he acts according as he wills, so he naturally concludes that everything acts in accordance with some superior will. Hence Fetichism, which is nothing but the endowment of inanimate things with life and volition. This is the logical necessity for the supernatural stage: the mind commences with the unknowable; it has first to learn its impotence, to learn the limits of its range, before it can content itself with the knowable.

"The metaphysical stage is equally important as the transitive stage. The supernatural and positive stages are so widely opposed that they require intermediate notions to bridge over the chasm. In substituting an *entity inseparable from phenomena* for a *supernatural agent, through whose will* these phenomena were produced, the mind became habituated to consider only the phenomena themselves. This was a most important condition. The result was, that the ideas of these metaphysical entities gradually faded, and were lost in the mere abstract names of the phenomena.

"The positive stage was now possible. The mind having ceased to interpose either supernatural agents or metaphysical entities between the phenomena and their production, attended solely to the phenomena themselves. These it reduced to *laws;* in other words, it arranged them according to their invariable relations of similitude and succession. The search after essences and causes was renounced. The pretension to absolute knowledge was set aside. The discovery of laws became the great object of mankind.

"Remember that although every branch of knowledge must pass through these three stages, in obedience to the law of evolution, nevertheless the progress is not strictly chronological. Some sciences are more rapid in their evolution than others; some individuals pass

through these evolutions more quickly than others; so also of nations. The present intellectual anarchy results from that difference; some sciences being in the positive, some in the supernatural, and some in the metaphysical stage: and this is further to be subdivided into individual differences; for in a science which, on the whole, may fairly be admitted as being positive, there will be found some cultivators still in the metaphysical stage. Astronomy is now in so positive a condition, that we need nothing but the laws of dynamics and gravitation to explain all celestial phenomena; and this explanation we know to be correct, as far as anything can be known, because we can predict the return of a comet with the nicest accuracy, or can enable the mariner to discover his latitude and find his way amidst the 'waste of waters.' This is a positive science. But so far is meteorology from such a condition, that prayers for dry or rainy weather are still offered up in churches; whereas if once the *laws* of these phenomena were traced, there would no more be prayers for rain than for the sun to rise at midnight. Remark, also, that while in the present day no natural philosopher is insane enough to busy himself with the attempt to discover the *cause* of attraction, thousands are busy in the attempt to discover the *cause* of life and the *essence* of mind! This difference characterizes positive and metaphysical sciences. The one is content with a general *fact*, that 'attraction is directly as the mass and inversely as the square of the distance;' this being sufficient for all scientific purposes, because enabling us to predict with unerring certainty the results of that operation. The metaphysician, or metaphysical physiologist, on the contrary, is more occupied with *guessing* at the causes of life, than in observing and classifying vital phenomena with a view to detect their laws of operation. First he guesses it to be what he calls a 'vital principle'—a mysterious entity residing in the frame, and capable of engendering phenomena. He then proceeds to guess at the nature or essence of

this principle, and pronounces it 'electricity,' or 'nervous fluid,' or 'chemical affinity.' Thus he heaps hypothesis upon hypothesis, and clouds the subject from his view.

"The closer we examine the present condition of the sciences, the more we shall be struck with the anarchy above indicated. We shall find one science in a perfectly positive stage (Physics), another in the metaphysical stage (Biology), a third in the supernatural stage (Sociology). Nor is this all. The same varieties will be found to coexist in the same individual mind. The same man who in physics may be said to have arrived at the positive stage, and recognises no other object of inquiry than the *laws* of phenomena, will be found still a slave to the metaphysical stage in Biology, and endeavouring to detect the *cause* of life; and so little emancipated from the supernatural stage in Sociology, that if you talk to him of the *possibility* of a science of history, or a social science, he will laugh at you as a 'theorizer.' So vicious is our philosophical education! So imperfect the conception of a scientific Method! Well might Shelley exclaim—

'How green is this grey world!'

The present condition of science, therefore, exhibits three Methods instead of one: hence the anarchy. To remedy the evil, all differences must cease: one Method must preside. Auguste Comte was the first to point out the fact, and to suggest the cure; and it will render his name immortal. So long as the supernatural explanation of phenomena was universally accepted, so long was there unity of thought, because one general principle was applied to *all* facts. The same may be said of the metaphysical stage, though in a less degree, because it was never universally accepted; it was in advance of the supernatural; but before it could attain universal recognition, the positive stage had already begun. When the

positive Method is universally accepted—and the day we hope is not far distant, at least among the élite of humanity—then shall we again have unity of thought, then shall we again have one general doctrine, powerful because general.

"That the positive Method is the only Method adapted to human capacity, the only one on which truth can be found, is easily proved: on it alone can *prevision* of phenomena depend. Prevision is the characteristic and the test of knowledge. If you can predict certain results, and they occur as you predicted, then are you assured that your knowledge is correct. If the wind blows according to the will of Boreas, we may, indeed, *propitiate* his favour, but we cannot *calculate* upon it. We can have no certain knowledge whether the wind will blow or not. If, on the other hand, it is subject to laws, like everything else, once discover these laws, and men will predict concerning it as they predict concerning other matters. 'Even the wind and rain,' to use the language of Dr. Arnott, 'which in common speech are the types of uncertainty and change, obey laws as fixed as those of the sun and moon; and already, as regards many parts of the earth, man can foretell them without fear of being deceived. He plans his voyages to suit the coming monsoons, and prepares against the floods of the rainy seasons.'

"If one other argument be needed, we would simply refer to the gradual and progressive improvement which has always taken place in every department of inquiry conducted upon the positive Method—and with a success in exact proportion to its rigorous employment of that Method—contrasted with the *circular* movement of Philosophy, which is just as far from a solution of any one of its problems as it was five thousand years ago; the only truths that it can be said to have acquired are a few psychological truths, and these it owes to the positive Method!"

SECTION IV.

CLASSIFICATION OF THE SCIENCES.

HITHERTO I have adhered very little to Comte's own exposition of his system. By a more popular and discursive exposition, I have endeavoured to familiarize the reader with the point of view from which to study the Positive Philosophy; but in treating of the luminous conception of a new and final classification of the sciences, it will be well to do so as much as possible in Comte's own words. Those who have never examined the subject of classification will fail to appreciate the gigantic force of philosophic thought implied in this scheme. The arrangement seems so natural, so obvious, that an acute thinker reviewing Comte in Blackwood's Magazine, expressed, what is perhaps a very general impression, in saying it was just the sort of classification that would naturally arise in any reflective mind on a review of the subject. Had this critic only remembered the abortive attempts made by Bacon, D'Alembert, Stewart, Ampère, and others, he would never have suffered that phrase to have escaped him.

Without, however, criticising the attempts of previous thinkers, let us examine the principle laid down in the Positive Philosophy. The problem before us is this: *How to arrange the sciences that the classification may itself be the expression of the most general fact apparent on a profound investigation of the objects* which this classification includes. The solution of the problem lies in this: *the dependence of the sciences can only result from that of the corresponding phenomena.*

Science is a knowledge of the laws of nature. This knowledge is the only rational basis of man's action on nature. By it, he foresees what will be the result of the working of any phenomena left to their own spontaneous activity, and by what modifications he may produce a different result more advantageous to himself. *Science* gives power to *foresee*, and *foreseeing* leads to *action*. Hence the relation of Science and Art.

Science leading in this way to the Useful, and there having been so much cause in modern times for appreciating the practical ends it serves, its cultivation has become too much associated with ideas of mere profit and utility. Comte here, as elsewhere, warns us against losing sight of its higher function—that of *satisfying a fundamental want of our nature*. As intelligent beings we have an insatiable craving to know the laws of nature. For this purpose, when in want of *positive* conceptions, we resort to the *theological* or *metaphysical* conceptions.

The laws of phenomena (theoretical science), and the application of those laws to practical purposes, forming two distinct branches of speculation, the latter subject, it may be inferred, does not fall within the scope of Comte's system.

He makes another elimination. Natural sciences are of two kinds—the one abstract, the other concrete, special, descriptive. The first are the fundamental sciences; the latter are secondary. The working of the abstract laws in particular instances gives rise to the concrete laws. General physiology is abstract; zoology and botany are concrete. So with chemistry and mineralogy: in chemistry we consider all possible combinations of matter; in mineralogy we consider only the combinations which we find actually existing in the minerals. It is Abstract Physics only which fall within Comte's classification.

To enter now directly upon the great question before us, we must at the outset recall to mind that, in order to

obtain a natural and positive classification of the fundamental sciences, we have to seek for the principle in a comparison of the different orders of phenomena whose laws it is their object to discover. What we wish to determine is, the actual dependence of the various sciences among themselves. Now this dependence can only result from that of the corresponding phenomena.

Considering all observable phenomena under this point of view, we shall see that it is possible to classify them in a small number of natural categories, disposed in such a way that the rational study of each category may start from a knowledge of the principal laws of the preceding category, and become, in its turn, a foundation for the study of the succeeding. This order is determined by the degree of simplicity, or, what comes to the same thing, by the degree of the *generality* of the phenomena. From this difference in simplicity or generality result the successive *dependence* of the phenomena, and, as a consequence, the greater or less facility with which they may be studied.

In fact it is, *à priori*, clear, that the simplest phenomena, those which are least complicated with others, are necessarily the most general also; because that which occurs in the greatest number of cases is, from that very fact, to the greatest possible degree unconnected with, and independent of, the circumstances peculiar to each separate case. We must therefore commence with the study of the most general or the most simple phenomena, and then proceed in succession to the most complicated, if we would conceive natural philosophy in a truly methodical way; for since this order of generality or simplicity necessarily determines the rational connection of the different fundamental sciences by the successive dependence of their phenomena, it also fixes their comparative degrees of difficulty.

Our first survey of the ensemble of natural phenomena leads us at the outset to divide them, agreeably to the

principle which we have just established, into two great classes—the first comprehending all the phenomena of *inorganic* bodies, the second all those of *organized* bodies.

The latter are evidently more complex and more special than the former; they depend on the preceding phenomena, which, on the contrary, do not depend on them; hence the necessity of studying physiological phenomena only after those of inorganic matter. In whatever way we explain the differences of these two modes of existence, it is certain that we observe in living bodies all the phenomena, both mechanical and chemical, which have place in inorganic bodies, and besides these, an entirely special order of phenomena—vital phenomena —those peculiar to *organization*. Organized and inorganized matter may, or may not, considered as *noumena*, be of the same *nature;* the philosophy eschews such inquiries; it is enough that there is a recognised difference between them such as to require them to be studied separately, and that, on any hypothesis as to the nature of this difference, general phenomena ought to be studied before their special modifications.

This is not the proper place for a general comparison between organized and inorganized matter. At present, it is sufficient that we recognise the logical necessity of separating the science which embraces organised matter from that relating to inorganized matter, and of not proceeding to the study of *organic physics* till after having established the general laws of *inorganic physics*.

As to *inorganic physics*, we see at once that by continuing to adhere to the order of generality and of dependence of the phenomena, they must be divided into two distinct sections, according as they refer to the general phenomena of the universe, or specially to those which are presented to us by terrestrial matter. Hence we have celestial physics, or astronomy, geometrical and mechanical; and terrestrial physics. There is the same

necessity for this division as there was for the preceding one.

Astronomical phenomena being the most general, the most simple, and the most abstract of all, it is evident that the study of natural philosophy ought to commence with them, since the laws to which they are subject act on those of all other phenomena, they themselves being, on the contrary, essentially independent. In all the phenomena of terrestrial physics, we observe the general effects of universal gravitation, besides certain other effects which are peculiar to themselves, and which modify the first. It follows that when we analyze the simplest terrestrial phenomenon, whether chemical or even purely mechanical, we always find it more compound than the most complex celestial phenomenon. It is thus, for example, that the simple movement of a falling body, even when that of a solid only, really offers (if we would take into account all the influencing circumstances), a more complicated subject of inquiry than the most difficult astronomical question. This consideration clearly shows how indispensable it is that a distinct separation be made between celestial physics and terrestrial physics, and of passing to the study of the second only after the first, which is its rational basis.

Terrestrial physics are, in their turn, subdivided into two very distinct portions, according as they relate to bodies considered under the *mechanical* point of view, or under the *chemical*. In order to conceive the former in a truly methodical manner, there is evidently implied a previous knowledge of the other. For all chemical phenomena are necessarily more complex than physical phenomena; they are dependent on them, without acting on them. Every one knows that all chemical action is subject to the influence of weight, heat, electricity, &c., and that, at the same time, it manifests something peculiar to itself which modifies the action of the preceding agencies.

The above, therefore, is the rational division of the principal branches of the general science of inorganic bodies. There is an analogous division, formed in the same manner, in the general science of organic bodies.

All living beings present two orders of phenomena essentially distinct—those relating to the individual, and those relating to the species, more especially when it is sociable. It is chiefly in respect to man that this distinction is fundamental. The latter order of phenomena is evidently more complicated and more special than the former: it is dependent on it without influencing it. Hence, two great sections in *organic physics*, namely, physiology, properly so called, and social physics, which are founded on physiology.

In all social phenomena, we observe in the first place the influence of the physiological laws of the individual, and also something special, which modifies their effects, and which concerns the action of individuals on one another.

This influence is singularly complicated in the human species by the action of each generation upon its successor. Hence it is evident, that in order to study social phenomena in a proper way, it is necessary to begin with a profound knowledge of the laws relating to individual life. On the other hand, it by no means follows from this necessary subordination between the two subjects of study (as some physiologists of the first rank have been led to believe), that we only see in social physics an appendix to physiology. Although the phenomena may certainly be homogeneous, they are not at all identical; and it is of radical importance to make a separation between the two sciences. For it would be impossible to treat the study of the species under the collective point of view, as a pure deduction from the study of the individual, since the social conditions which modify the action of the physiological laws become there the most essential object of consideration. It follows

that social physics ought to be based upon a body of direct observations, suitable to it,—having the while due regard, as is proper, to its intimate and necessary connection with physiology, properly so called.

We find, as the result of this discussion, that Positive Philosophy is naturally divided into *five fundamental sciences,* whose succession is determined by a necessary and invariable subordination, based upon the simple, but profound, comparison of the corresponding phenomena. These sciences are—astronomy, physics, chemistry, physiology, and lastly, sociology. The first relates to phenomena the most general, the most simple, the most abstract, and the most remotely connected with humanity; they act on all the others, without being acted on by them. The phenomena falling under the last, are, on the contrary, the most special, the most complex, the most concrete, and the most directly interesting to man; they depend more or less on all the preceding ones, without exercising any influence upon them. Between these two extremes, the degree of speciality, of complication, and of individuality of the phenomena, is gradually increasing, as well as their successive dependence.

One very essential characteristic of our classification is, its necessary conformity to the actual order of the development of natural philosophy. This is verified by all we know of the history of the sciences, particularly during the two last centuries, where we are able to follow their course more exactly.

Indeed, one sees that since the rational study of each of the fundamental sciences requires, as a preliminary, the cultivation of all those that precede it in the encyclopædical hierarchy, it could have made no real progress, nor could it have assumed its true character, until after a great development of the anterior sciences relative to phenomena more general, more abstract, and less complex, and independent of the others. It is,

therefore, in this order that the progression, although simultaneous, must have taken place.

This consideration is, in Comte's eyes, so important, that he believes it impossible really to comprehend the history of the human mind without paying regard to it. The general law of human Evolution cannot be properly understood, unless, in its applications, we combine it with the encyclopædical formula just established. For, it was in the order laid down in this formula that the different theories held by mankind reached successively, first, the theological state, next, the metaphysical state, and last of all, the positive state. If we do not take it into account when referring to the operation of the law of this necessary progression, we shall often meet with difficulties which appear insurmountable, since it is clear that the theological or metaphysical state of some fundamental theories must have temporarily coincided with each other, and in fact coincided at times with the positive state of those which go before them in our encyclopædical system,—a circumstance which tends to throw upon the verification of the general law an obscurity that can only be dispelled by the preceding classification.

In the third place, that classification presents the very remarkable property of marking with exactness the relative states of perfection of the different sciences, —a perfection which consists essentially in the degree of precision with which the phenomena are known to us, and in the more or less intimate co-ordination of our knowledge of them.

The more general, simple, and abstract the phenomena, the more precise are our ideas with respect to them. Mathematical propositions, for example, are the most precise of all. But Comte reminds us that *precision* is one thing, *certainty* another. An absurd and false proposition may be made very precise, and, on the other hand, although the sciences vary in the degree of precision, they all present results equally certain. The reader should not suppose that any one science is less

certain in its results than another, because it is less precise.

Lastly, the most interesting characteristic of the encyclopædical formula, on account of the importance and multiplicity of the immediate applications which we can make of it, is that of directly determining the true general plan of a scientific and entirely rational education. This is a direct consequence of the very composition of the formula.

It is evident, in fact, that before undertaking the methodical study of any one of the fundamental sciences, it is absolutely necessary to be prepared by an examination of such of them as refer to the phenomena that go before it in the encyclopædical scale, since the latter always weightily influence those whose laws are to be the subject of study.

If the remark is eminently applicable to general education, it is as much so to the special education of *savans*. The natural philosophers who have not in the first place studied astronomy, at least under the general point of view; the chemists who, before occupying themselves with their own science, have not previously studied astronomy, and, after it, physics; the physiologists who have not prepared themselves for their special labours by a preliminary study of astronomy, of physics, and of chemistry;—all want one of the fundamental conditions of their intellectual development. It is still more evident in the case of those minds who would devote themselves to the positive study of social phenomena without having first acquired a general knowledge of astronomy, physics, chemistry, and physiology.

It is a proposition at the very root of Comte's system, that until the sciences are learned in their natural order, which at present is seldom the case, a scientific education will be incapable of realizing its most general and essential results.

He proceeds to point out that it is not only as to

doctrine that his encyclopædical law serves as a basis for a scientific education; it is of equal importance as to *method*. In passing from one science to another, we discover the several modifications which method (essentially the same in all) undergoes. A proper knowledge of the positive method can only be acquired in this way. Each science develops characteristic processes of its own: one, observation—another, experiment of one sort—a third, experiment of another sort. And they ought to be taken in the encyclopædical order. What rational product, of any great national superiority, can come from a mind which occupies itself from the very outset with the study of the most complicated phenomena, without having first been made to understand, by an examination of the most simple phenomena, what it is we call a *law*,—what it is *to observe*,—what is a positive conception,—what even is logical reasoning? Such, however, is still at this day the ordinary course of our young physiologists, who most frequently commence directly the study of living bodies, without having received any other preparation than a preliminary education, limited to the study of one or two dead languages; and having but a very superficial knowledge of physics and chemistry,—a knowledge almost amounting to nothing, so far as respects Method, seeing that generally it has not been obtained in a rational manner, nor by proceeding from the true starting point of natural philosophy. While, in respect to social phenomena, which are more complex still, would it not be taking a great step towards the return of modern society to a truly normal state, to recognise the logical necessity of only proceeding to the study of these phenomena, after having gradually trained up the intellectual organ by a profound and philosophical examination of all the anterior phenomena? We may even say, with the utmost correctness, that the main difficulty lies wholly here. For there are few intel-

ligent minds who are not now convinced that it is necessary to study social phenomena according to the Positive Method. Owing to those who are engaged in the study not knowing, and not being able to see exactly wherein this Positive Method consists, from not having examined it in its anterior applications, this maxim has hitherto been almost sterile in renovating social theories, which are not as yet out of the theological or metaphysical state, notwithstanding the efforts of professed positive reformers.

The reader may have marked the omission of mathematics in the encyclopædical scale. This science, however, is placed by Comte, in virtue of the principle of his classification, at the very head of the scale. But he regards this vast and important science less as a constituent part of natural philosophy than as the *true and fundamental basis of it;* and he values it not so much for its own intrinsic truths, as for its being the great and most powerful instrument in furthering the progress of science.

SECTION V.

WHAT ARE THE LAWS OF NATURE?

THE three great initial conceptions of the Positive Philosophy having been set forth in the preceding sections, I will now give some analysis of the six volumes of scientific exposition forming the *Cours de Philosophie Positive*. But, before finally leaving the subject of Comte's Law of Evolution, I will insert a note addressed to me by a friend, which may help to clear up some obscurities in my own exposition. The importance of the law warrants our dwelling on it:—

"The following observations may perhaps prove serviceable to the younger students of the Positive Philosophy. In the Law of Evolution, they must not suppose, as many do, that each of the three periods had a separate and exclusive existence. On the contrary, the Theological, Metaphysical, and Positive elements have always co-existed. But in the first period, Theology has been the predominating element; in the second, Metaphysical; in the third, Positive conception has predominated. The germ of Positivism will be found even in the Fetichistic stage; nor was man ever absolutely incapable of Abstraction. On the other hand, the Positive period will not entirely exclude the initial and intermediate tendencies of the human mind. It should be observed, too, that these three states are all closely connected; for the Metaphysical is a transition state, and is partly theological and partly scientific. The chasm between Supernaturalism and Positivism is bridged over by Metaphysics. Without it Humanity would never have arisen; for *natura non agit per saltum*. The principle of gradation or continuity, the charac-

teristic of nature, is also the characteristic of the new Philosophy, and will be found to underlie all its logical and scientific conceptions. As an illustration, I subjoin a passage from Sir John Herschel's *Discourse*:—'There can be little doubt that the solid, liquid, and aëriform states of bodies are merely stages in a progress of gradual transition from one extreme to the other; and that, however strongly marked the distinctions between them may appear, they will ultimately turn out to be separated by no sudden or violent line of demarcation, but shade into each other by insensible gradations.'"

The present is a favourable occasion for bringing forward a criticism on the much-used and much-abused term, "Laws of Nature," which for nearly twenty years I have employed with misgiving. The phrase has two vices: it is inaccurate, and it is misleading; and a severe critic might not unreasonably condemn its employment in Positive Philosophy. The conception implied in, or suggested by, the phrase, "Laws of Nature," is the last and most refined expression of the Metaphysical stage of speculation: in it Law replaces the ancient Principle: in it Law is the delicate abstract Entity *superadded* to the phenomena. For observe: when you say it is according to a *law* that bodies gravitate, that fluids ascend to their level, or that the needle points towards the north, you are superadding to the *facts* an abstract entity (Law), which you believe coerces the facts, makes them to be what they are; you give a generalized statement of the facts, and out of it you make an entity —a something *ab extra*. What is this law which produces the phenomena, but a more subtle, a more impersonal substitute for the Supernatural Power which, in the Theological epoch, was believed to superintend all things,

"To guide the whirlwind and direct the storm?"

If the Savage says it is a Demon who directs the

storm, does not the man of science say it is a Law which directs it? These two conceptions, are they not identical?

When we consider that a man of the vast attainments and high position of Cuvier could argue as if Law really meant a superimposed regulation, it is time to object to the word. In his celebrated discussion with Geoffroy St. Hilaire, on the Unity of Composition in the Animal Kingdom, Cuvier so completely forgets himself as to ask, "Wherefore should Nature always act uniformly? What necessity could have constrained her only to employ the same organic forms, and always to have employed them? By whom could this arbitrary rule have been imposed—*par qui cette règle arbitraire lui aurait-elle été imposée?*" Thus we see the identity of organic processes is considered by him as an "arbitrary rule;" he prefers a capricious one! Elsewhere he returns to this argument, and declares that St. Hilaire's "pretended identities" would, *if true*, reduce Nature to a sort of slavery!*

Law, then, even in its Metaphysical acceptation, was too rigorous for Cuvier's views; he repudiated the idea of Nature being subject to it; and he certainly could not have understood by the phrase, "law of nature," the mere "relation of co-existence and succession."

It will be answered, perhaps, that men of science in general do *not* so conceive Law. They do not believe that the ever-living activities we in our profound ignorance christen "Nature," are moved according to certain celestial Statutes, with "pains and penalties" thereunto attached. But my objection is not the less valid. The current language of men habitually expresses this conception; and although, when their attention is directed to it, when they begin rigorously to define terms, they call a Law the "expression of the relations of coexistence

* Geoffroy St. Hilaire, *Philosophie Zoologique*, pp. 7 and 25.

and succession," yet their language about "breaking the laws of Nature," acting "contrary to the laws of Nature," indicates the misleading suggestions of the term. Much of their reasoning is vitiated by it. Thus, to go no farther than that form of the Development theory which assumes a certain fixed and definite Plan in the Universe—are not the Laws which work out this Plan supposed to be endowed with a mysterious *prescience* of the end they are to reach? And what are prescient laws but metaphysical entities?

Nevertheless, that the Creator has subjected matter to certain immutable laws, is a conception which most men of science loudly proclaim; and however they may refine upon terms, and sublimate the idea of Law, its *human* element cannot always be eliminated. But this seems to me a *mechanical* theory of the universe, both sterile and irreligious: it makes God necessary as a postulate, and there leaves him! He having legislated for the Universe once for all, the *laws* are now sufficient to sustain the great life of the universe! According to the *dynamic* conception, in which God is Life, and the Universe his Activity, such notions of Law are profoundly erroneous; and I object therefore to the term Laws of Nature, because its direct meaning points to a *mechanical* conception of Nature, and because, however we may circumscribe its meaning, as expressive simply of the relations of co-existence and succession, the word Law does and must bring with it its human associations, and must therein be delusive. Rather than the popular, and, as one may call it, mechanical theory of the Universe, let us have the primitive spontaneous theory current during the earlier stages of Humanity: I can accommodate myself better with the old Deities—capricious and human as they are—than with the modern Laws; for the Deities at least were *living* powers. Spinoza and Goethe teach us something better than the mechanical theory, and to them I refer the reader.

Let us suppose it granted that the term Law is objectionable. What shall be the substitute? The difficulty of finding one has been very great. The "mind in the spacious circuit of its musing" alighted on terms all clogged with intrusive and delusive meanings, which unfitted them for replacing the old term. The one upon which I finally settled does not altogether satisfy me, but it fulfils the main requisites.

I propose to call the relations of coexistence and succession, usually named Laws, by the name of Methods. Etymologically, Method (μεθοδος) is a *path* leading onwards, a way of transit. The Methods of Nature would therefore express the paths along which the activities of Nature travelled to results (phenomena). I cannot avoid figurative language, and it is useful, because expressive; but the conception here expressed is limited to the facts, with nothing superadded. Given the phenomena, we name the process by which they are called forth the *Way* of Nature—the path Forces take to that particular result. These paths may be intersected by the paths of other Forces. For instance, a spark will ignite dry gunpowder. Here a particular path is opened, along which Forces can travel to a particular issue (explosion); but if we throw water on the powder, *the* particular path is blocked up, and another issue is reached. Fire raises the temperature of water. Yet, if you pour water into a red-hot crucible containing liquid sulphuric acid, the temperature of the water is *not* raised; nay, so far from that, it is lowered to the freezing point, and in lieu of steam you have ice! This is no contradiction to the Laws of Nature; no law is broken; all we can say is that the path is intersected by another path, thus: The rapid evaporation of the sulphuric acid produces cold so intense that the water which (the acid absent) would have hissed off in steam, now not only loses in evaporation all the heat given it by the fire, but also loses a portion of that heat which kept it liquid. And this is

simply because the Method of Nature—the true path of her activity as regards sulphuric acid subjected to heat —is what we call rapid evaporation.

To understand this conception of Methods, let us place ourselves at the most abstract point of view: let us consider Nature as the sum of Forces, which, because they *are*, and are Forces, must act, and must act along some pathway or other—and let us further consider these Forces about to leap into results—we can only consider them as travelling along certain definite paths to reach certain definite results. We thus see that the path of activity is one of the *conditions* of an act; and that to the observed actions we superadd nothing not given in the actions themselves, by declaring such and such to be the Methods of Nature.

I try various forms of expression, and various illustrations, to familiarize my meaning. Let me take one from the science of Mechanics. Matter is said to be *inert*: as a scientific artifice this may be useful in mechanics, but out of that domain to consider matter as incapable of spontaneously modifying the action of forces applied to it, is a remnant of the old Metaphysical notion, that all states of activity and movement are produced *from without*; a notion in accordance with the phase of mental development when movement was explained by supernatural entities; a notion in accordance with the mechanical theory of all matter being a "lifeless mass of clay in the potter's hands." I cannot bring myself so to consider it, but desire some considerable rectification of these gross conceptions of matter. I would view it as the *phenomena of Force*, and say that all matter, animate and inanimate, is everywhere in a state of spontaneous activity—of Life, in short; a conception to which all modern science is rapidly tending. And having once so conceived it, we should conclude that the movements of matter are not *obedient to Laws*, but are the spontaneous activities of the Forces; and

what we call Laws are nothing but the paths, or Methods, along which the Forces move.

That there are objections incident to the use of the term Methods, I am aware; is it possible to avoid objections? Moreover, I am not Quixotic Neologist enough to expect that the old term will fall out of use, even should a new term, wholly free from objection, be suggested. But I think this digression will not have been superfluous, if it serve to fix the students' attention on the characteristic effect of the conception of Law, and if it cause him, when he meets with the term Law, mentally to correct it into Method. Without at once altering our scientific phraseology, we may at once accustom our thoughts to Methods of Nature, and so familiarize ourselves with the positive spirit of regarding Nature.

We shall now have to treat of the science of Mathematics; and let me beg the reader to whom the following section may appear *dry*, because of his feeble interest in mathematics, to go resolutely through it nevertheless, for the sake of its illustration of the true scientific spirit. He needs no preliminary knowledge of mathematics to understand all that Comte will have to say.

SECTION VI.

PHILOSOPHICAL CONSIDERATIONS ON THE MATHEMATICAL SCIENCES.

THE object of Mathematical science is the measurement of magnitudes. *Direct* measurement, by simple immediate comparison of one magnitude with another known one, is seldom possible; and hence the necessity for the formation of a *science* of measurement. We discover the relation of a magnitude, not susceptible of immediate measurement, to another which is susceptible of measurement—what *function* the one is of the other. Then, in any given case, we can, from the immediate measurement of the one quantity, indirectly arrive at the measurement of the other. Thus (to take a familiar example) the height from whence a body has fallen, and the time of its fall, have always a fixed relation. The two magnitudes are *functions* of each other. Hence, in the case where we can measure the *time* of the fall of a body from a precipice, the time gives us the *height*; and in an inverse case, we can tell the time a body would take to fall vertically from the moon to the earth, from our knowledge of the distance between the moon and the earth. So, also, from knowing the fixed relations between the sides and angles of a triangle, we can in any given case, from a direct measurement of some of these parts, ascertain the measurement of the remaining. The unknown magnitude, however, may not be ascertained by a knowledge of its relation merely to *one* other; it may be, that we require to know what function the unknown magnitude is of a second, and the second

of a third, and the third of a fourth, and so on through a long chain; none of the series except the last term being capable of immediate measurement. But the principle in all the cases, simple or complex, is identical.

The exact definition of mathematical science may therefore be arrived at by assigning as its object the *indirect* measurement of magnitudes, and by saying that our aim in it always is *to determine one magnitude from another, by means of the exact relations which exist between them.* This way of defining mathematics, instead of giving the idea of an *art* only, as all definitions have hitherto done, characterizes directly a true science, and shows it, at once, to be composed of a vast series of intellectual operations, which may evidently become very complicated, by reason of the chain of intermediate terms which it may be requisite to establish between the unknown quantities and those allowing of direct measurement,—of the number of co-existing variables in a given question—and of the nature of the relations among all these various magnitudes presented by the phenomena under consideration. According to this definition, it is in the very spirit of mathematics always to regard all quantities which any phenomenon whatever can present to us, as mutual relations, so that they may be deduced from each other. Now, there is evidently no phenomenon that cannot give room for considerations of this kind; whence naturally result the indefinite extent and even the strict logical universality of mathematics.

The foregoing explanations clearly justify the employment of the name used to designate the science in question. This appellation, which has now received so fixed an acceptation, signifies by itself simply *science* in general. This designation, which in Greek usage was quite exact, seeing that they had no other real science, has been only retained by the moderns to indicate that mathematics is *the science* par excellence. And indeed

the definition given above (leaving out of account the different degrees of precision) is nothing but the definition of every real science whatever: for has not each of them for its necessary aim to determine one phenomenon from another, by means of the relations which exist among them? All *science* consists in the *co-ordination* of facts. If our different observations were entirely *isolated,* there would be no science. We may even say that, in so far as the different phenomena will permit, *science* is essentially *destined to dispense with all direct observation,* by allowing us to *deduce the greatest possible number of results from the smallest possible number of immediate data.* It is in this that lies the real use, in speculation, as well as in action, of the *laws* which we are discovering among natural phenomena. In this view, Mathematics only pursue, with regard to subjects truly within their province, the same kind of inquiries as are followed out in greater or less degree by each of the exact sciences, in their respective spheres,—with this difference, that mathematics carries them to the highest possible point, both with respect to quantity and quality.

It is, then, by the study of mathematics, and it alone, that we can obtain a just and comprehensive idea of what a *science* really is. It is in that study we ought to learn precisely the general method always followed by the human mind in its positive researches; for nowhere else are questions resolved so completely, and deductions prolonged so far with extreme rigour. It is there, too, that our intelligence has given the greatest proofs of its power, since the ideas dealt with are the most entirely abstract possible in positive science. All scientific education which does not commence with this study, is therefore and of necessity defective at its foundation.

Hitherto Comte has been speaking of mathematics in their totality. Now let us glance at their principal divisions.

In the complete analysis of a mathematical question, the science is seen spontaneously separating itself into two great divisions. In the first place we have to ascertain the precise relations actually existing between the quantities under consideration. Thus, in order to determine the height from which a body has fallen, from the time of the fall, we have to discover the *equation* between height and time. This constitutes the *concrete* part of mathematics.

In the second place, we have a pure question of numbers before us. Having the *equation*, we have simply to determine the unknown numbers from the known. The height being a known multiple of the second power of the time (such being the *equation* in the particular case referred to), we have to perform the numerical operation of finding the one from the other. This is the *abstract* part of mathematics.

Sometimes the concrete part is the more difficult; sometimes the abstract; and these two great branches of mathematics may be considered as equal in extent and in difficulty. They are as distinct in their object as in the nature of the inquiries embraced by them. *Concrete* mathematics depend upon the kind of phenomena under consideration, and are essentially experimental, *i. e.* physical. *Abstract* mathematics are independent of the objects examined, except as to their numerical relations; they are purely logical, *i. e.* rational.

Concrete Mathematics, having for their object the discovery of the equations of phenomena, ought *à priori* to be composed of as many distinct sciences as there are categories of phenomena. Practically, however, the only two great categories of phenomena, of which we can always know the equations, are the Geometrical and Mechanical. Hence Concrete Mathematics subdivide themselves into the sciences of *Geometry* and of *Mechanics*. These two are natural fundamental sciences, inasmuch as all natural effects can be conceived as simple

and necessary results either of extension or of movement.

Abstract Mathematics, on the other hand, are composed of the Calculus in its widest sense,—embracing all numerical operations from the simplest to the highest combinations of transcendental analysis. They have for their object the resolution of all questions of numbers,—starting from the equations yielded by concrete mathematics.

It is of importance to notice that the fundamental division of mathematics is only an application of the general principle of Classification established in a preceding section, viz. the hierarchy of the different positive sciences. If, in fact, we compare the Calculus on the one side, with Geometry and Mechanics on the other, we truly find, as respects the ideas considered in each of these two primary divisions of mathematics, the essential characteristics of our Encyclopædical Method. The analytical ideas of the Calculus are evidently more abstract, and also more general and more simple, than geometrical or mechanical ideas. Although the principal conceptions of Mathematical Analysis regarded under the historical point of view, were formed under the influence of geometrical or mechanical considerations (with whose progress that of the Calculus has been closely connected), Analysis, nevertheless, is, under the logical point of view, essentially independent of Geometry and Mechanics, while the latter are, on the contrary, necessarily founded on the former.

Mathematical Analysis is therefore, according to the principles laid down, the true and rational basis of the complete system of our positive knowledge. It is the first and the most perfect of all the fundamental sciences. The ideas which form its subject-matter are the most universal, the most abstract, and the most simple that we can actually conceive.

This peculiar characteristic of Mathematical Analysis allows us easily to explain why it affords so powerful an

instrument when properly used, not only of giving additional precision to our real knowledge (which is self-evident), but also of establishing an infinitely more perfect co-ordination in the study of phenomena which permit its application. For, the conceptions having been generalized and simplified to the highest possible degree, so that a single analytical question resolved abstractly contains the implicit solution of a number of different physical questions, the result must necessarily be that the human mind will have a greater facility in perceiving the relations between phenomena which at first sight appear altogether isolated from each other, and from which we thus come, by considering it apart, to make out all they have in common. It is thus that in examining the progress of the intellect in the solution of important questions of Geometry and Mechanics, we see that, by the intervention of Analysis, there have naturally come to light the most frequent and the most unexpected similarities among problems which did not at first appear to present any connection, and which in the end we often regard as identical. How could we, for example, have perceived without the aid of analysis the least analogy between the determination of the direction of a curve to each of its points, and that of the velocity acquired by a body at each instant of its varied movement? Questions, which, however different they may be, are only one in the eyes of a geometrician.

And in like manner it is easy to understand the high state of perfection of Mathematical Analysis, compared with the other sciences, which is owing not to its signs, but to the extreme simplicity of its ideas.

Comte concludes by showing the real extent of the domain of the mathematical science. In the purely logical point of view, it is necessarily *universal*. Every question can be conceived as being ultimately resolved into one of number. But its domain is practically circumscribed to the less complex questions of Inorganic Physics, on two accounts:—

First: Because the different quantities presented in the more complex questions of Inorganic Physics, and in *all* Organic questions, do not permit fixed numbers, so as to give us the requisite equation; the numerical variability of their phenomena is, extreme, and bids defiance to our powers of observing and fixing their value; and

Secondly: Because even if we knew the mathematical law of each agent, we could not solve the corresponding mathematical problem, by reason of the great complexity of the conditions.

Want of space prevents me from giving this part of Comte's exposition at length; but the reader will be at no loss to find illustrations of both cases.

Passing over the six profound and instructive chapters which follow—on Abstract Mathematics or Mathematical Analysis—we come to the preliminary chapter on Geometry.

Geometry is not, as many have supposed, a purely rational science, independent of observation; certain primitive phenomena, not established by reasoning, but founded on observation, must constitute the basis of its deductions. It has a scientific superiority to Mechanics, and precedes it—because it is more universal, more simple, and more independent than Mechanics. Every body in nature may give rise to geometrical as well as mechanical questions; and we never have the latter without the former; but even if the universe were to become immoveable, we should still have geometrical questions to solve.

This is the definition of geometry: *it has to measure extension.* But direct measurement of a solid or a surface by superposition of another solid or surface is, as a general rule, impracticable. There are always, however, in the case of a solid or of a surface, certain lines whose measurement will give the measurement of the solid or surface. In like manner, a curved line may be measured by certain right lines related to it; and right

lines themselves may in their turn be measured by their relations to other right lines susceptible of immediate comparison.

We can thus form a very precise idea of the science of geometry, by assigning it the general object of ultimately reducing comparisons of all species of extensions, solids, surfaces, or lines, to single comparisons of right lines, which are the only comparisons considered susceptible of being immediately made.

The *extent* of the science is necessarily indefinite; for the variety of lines, surfaces, and volumes is indefinite. To measure these various natural forms, as they offer themselves, we require to be prepared by a general study, and by a special examination of certain hypothetical and more simple forms. Hence it is not enough to confine ourselves, as the ancient geometricians did, to the study of certain simple forms directly furnished by nature, or of others deduced from them; we prepare ourselves for all imaginable forms by the abstract or modern Geometry, which we owe to Descartes, and which reduced the invention of forms to that of equations of right lines. Each equation, and consequently each form, could thus be specially studied. These equations being infinite in number, prepare us for all forms. But there are certain geometrical questions which at first sight do not appear to fall within Comte's definition. These refer to the *properties* of particular lines or surfaces. A single form may have many properties, each of which may more conveniently than the others lead to a solution in a particular case. By copious illustration, he shows how these questions really and essentially serve the purpose of facilitating measurement.

He then proceeds to point out the two different Methods which may be pursued in forming the Science of Geometry. He discards the phrases, *Synthetical* and *Analytical* Geometry, usually employed to designate them. The one would be better characterised as the

Geometry of the Ancients; the other as the *Geometry of the Moderns*. But instead of these historical appellations, he employs the term *Special* Geometry, for the former; *General* Geometry, for the latter. The radical difference between them, hitherto but imperfectly comprehended, seems really to consist in the very nature of the questions considered. In fact, Geometry supposed to be arrived at complete perfection, ought, as we have seen, on the one hand to embrace all imaginable forms, and on the other, to discover all the properties of each form. According to this double consideration, it is susceptible of being treated in two essentially distinct ways: either in grouping together all the questions, however different they may be, which concern the same form, and treating separately those relating to different bodies, whatever analogy may exist between them; or, on the contrary, in uniting under one and the same point of view all similar questions to whatever different forms they may belong, and separating the questions relative to the properties of the same body that are really different. In a word, the *ensemble* of Geometry can be fundamentally arranged either with reference to the bodies studied, or with reference to the phenomena to be considered. The first plan, which is the most natural, was that of the Ancients; the second, infinitely more rational, is that of the Moderns since the time of Descartes. Such is, in fact, the chief characteristic of ancient geometry, where we study, one by one, different lines and different surfaces, never passing to the examination of a new form until we believe we have exhausted every thing of interest which the known forms can give us. In this mode of procedure, when we undertake the study of a new curve, our labours upon the preceding ones do not directly afford any essential help, except in the geometrical exercise which the mind has obtained. In a word, the Geometry of the Ancients was, to use the expression above proposed, essentially *special*. In the

system of the Moderns, Geometry is, on the contrary, essentially *general;* that is, relative to *any* forms whatever. It is easy to understand that all geometrical questions of any interest can be proposed in reference to every imaginable form. The very few questions which are truly peculiar to this or that form are of the very least importance. This being granted, Modern Geometry essentially consists in making abstraction of every question relative to the same geometrical phenomenon in whatever body it may be considered, in order to treat it apart in a completely general way. The application of universal theories thus constructed for the special determination of the phenomenon under consideration in each particular body, is no longer regarded but as a secondary work, to be executed according to invariable rules, and whose success is certain beforehand. But we attach no real importance except to the conception and the complete solution of a new question belonging to any form whatever. Operations of this kind are alone regarded as advancing science. The attention of Geometricians being thus freed from the examination of the particular properties of different forms, and wholly directed towards general questions, they have been enabled to rise to the consideration of new geometrical notions, which, when applied to the curves studied by the ancients, have led to the discovery of important properties that they had not so much as suspected. Such is Geometry, since the radical revolution effected by Descartes in the general system of the science.

After pointing out the practical and incomparable superiority of the Modern over the Ancient method, Comte concludes by observing that we cannot dispense with the study of the latter. Historically speaking, it was required to enable Descartes to found the Modern method; and dogmatically it serves as the preliminary basis to General Geometry, in so far as it furnishes to the latter those *concrete equations* which are the groundwork of its analytical processes.

The 11th, 12th, 13th, and 14th lectures are devoted to the subjects of *special* and *general* Geometry. Let us pass to the 15th, which is entitled "*Philosophical considerations on the fundamental principles of rational Mechanics.*"

Mechanical phenomena follow Geometrical phenomena, in the order of simplicity, generality, and independence. The philosophical character of the Science of Mechanics (or, more properly speaking, *rational* Mechanics) is influenced to a greater degree than Geometry by a remnant of the Metaphysical habits of thought. A complete confusion exists in many minds between the *abstract* and *concrete* points of view in this science. The distinction is not properly made between the parts of it that are purely *physical* and those that are purely *rational*. The progress of this science for a century past has been due so much to Mathematical Analysis that the notion of mechanics being mere cases of Analysis obtained an easy acceptance. Its fundamental principles were supposed capable of establishment *à priori*—it being forgotten that Analysis is only a means of deduction, and that if Mechanics were founded on it solely, it would not be really applicable to the study of nature, as we find it to be. Comte's object in the 15th lecture is to free the subject from these Metaphysical notions, and make the separation between the *experimental* and *rational* parts of Mechanics apparent and distinct.

Let us commence by pointing out precisely the general object of the science. We are in the habit of remarking, and justly so, that Mechanics eschew the consideration not only of the first causes of movements, which are beyond the pale of Positive Philosophy, but also the circumstances of their production, which, although really forming an interesting subject of positive study in different branches of Physics, are quite without the province of Mechanics. That science is confined to a consideration of *movement* in itself, without enquiring into the

manner in which it was produced. Hence, *forces* are nothing in Mechanics but movements produced or tending to produce themselves; and two forces which impress on a body the same velocity in the same direction, are regarded as identical, however different their origin.

But although this manner of viewing the subject is fortunately now quite familiar to us, it is still left to Geometricians to effect an essential reform, if not in the conception itself, at least in our habitual language, in order to get rid entirely of the ancient metaphysical notion of *forces*, and to make out more exactly than has yet been done, the true point of view of Mechanics. We can now in a very precise manner characterise the general problem of rational Mechanics. It consists in *determining the effect which different forces, acting simultaneously, will produce upon a given body, when we know the simple movement which would result from the separate action of each of them*: or, taking the question inversely, in *determining the simple movements whose combination would produce a known compound movement*. This enumeration shows exactly what are, of necessity, the known and the unknown terms of any mechanical question. We see that the study of the action of a single force is, properly speaking, never within the domain of rational Mechanics, where it is always supposed to be known, because the second general problem is never susceptible of resolution, except as being the converse of the first. The whole of Mechanics, therefore, bears essentially on the combination of forces, whether there results from that concourse a movement whose different circumstances it is necessary to study, or whether the body, owing to their mutual neutralization, is in a state of equilibrium, whose characteristic conditions are required to be determined. These two general problems, the one direct, the other inverse, the solution of which constitutes the science of Mechanics, have an equal importance as respects their application;

for sometimes the simple movement can be studied by observation, while the compound resultant can only be got at by theory, and *vice versâ*. Comte gives several familiar illustrations of this.

Having thus expounded the general aim of Mechanics, Comte next considers the fundamental principles on which the science rests. As a preliminary step, he examines at length an important and necessary philosophical artifice used in Mechanics, without which no proposition on the abstract laws of equilibrium or movement could be established. This is the assumption that all bodies are *inert*: that is, not that they are subject to what is called the *law of inertia* (a different point altogether), but that they are of themselves incapable of spontaneously modifying the action of forces applied to them. It is in reality a pure assumption, for every body, animate and inanimate, is, to a greater or less extent, in a state of spontaneous activity or movement. The contrary belief is a remnant of the old metaphysical notion that matter is by its nature essentially inert, and that all states of activity and movement are produced from *without*—a notion in keeping with that stage of the mental development wherein movement is explained by supernatural *entities* or *causes*, but absolutely inconsistent with the positive point of view. Comte shows how the supposition of a body's inertness is made in Mechanics without impropriety. Movements in abstract mechanics being considered, as already observed, without reference to their mode of production, it matters not whether they come from within or from without. We can take the equivalent of the former in the latter.

It would be superfluous to say much, to make manifest the indispensable necessity of supposing bodies in this state of complete passiveness, where we have to consider only the external forces which are applied to them (as, for example, the movement of a falling body by the assumed entity *attraction*), for establishing the

abstract laws of equilibrium and movement. We may conceive that if it were necessary to take into account any modification whatever that a body in virtue of its natural forces can make on the action of these external agencies, we could not establish the least general proposition in rational mechanics; the more so, that this modification is far from being exactly known in the majority of cases.

Hence, it is only by commencing with a complete abstraction of them, so as to limit our thoughts to the reaction of the forces on each other, that it becomes possible to establish a science of *abstract* Mechanics. At a subsequent stage we pass from it to *concrete* Mechanics, by restoring to the bodies the active properties which are by nature inherent in them, but which at the outset we held as non-existent. It is this restitution which occasions our chief difficulty in passing from the abstract to the concrete in Mechanics,—a difficulty which singularly limits in practice the important applications of this science, whose theoretical domain is, from its nature, necessarily indefinite. To give an idea of the extent of this fundamental obstacle, we may say, that in the present state of Mathematics there is but one natural and general property of bodies which we can conveniently take account of,—that one being *gravity*, terrestrial and universal.

Hence the great applications of rational Mechanics have hitherto been really confined to celestial phenomena alone, and even to those of our own solar system; and here it is enough to consider only a general force of gravitation whose law is simple and well defined, and which, notwithstanding, presents difficulties that we cannot yet overcome completely, when we would rigorously take into account all the secondary actions susceptible of appreciable effects. We may thus conceive how complex questions must become when we pass to terrestrial mechanics, where the greater part of the phenomena, even

the simplest of them, probably never will allow, seeing the feebleness of our resources, of a purely rational and at the same time exact study of them according to the general laws of abstract Mechanics, although the knowledge of these laws (evidently indispensable on other accounts) can often lead to important *indications*.

As to the fundamental physical laws on which Rational Mechanics are founded, they are, according to Comte, *three* in number. They are generalised facts, the result of observation. They are the points from which the deductions of Science start, and are not themselves to be established *à priori*, as metaphysicians believe. He exposes the insufficiency of the *à priori* theory in each case, and the confusion of ideas which prevails in consequence of metaphysical conceptions on the subject.

The first of these laws is Kepler's *law of inertia*,—a universal law, applicable to all bodies, animate and inanimate.

The second is Newton's *law of action and reaction*.

The third is Galileo's discovery.

"This third fundamental law appears to me," he says, "to consist in what I propose to call the principles of *independence* or of *co-existence of movements*. It directly leads to what is popularly called the composition of forces. Galileo is, properly speaking, the real discoverer of this law, although he did not conceive it under the precise form which I have preferred giving it here. Considered under the simplest point of view, it comes to this general fact, that every movement strictly common to all the bodies of any system whatever, alters in no way the particular movements of those different bodies, as respects each other,—these movements continuing to be the same as if the *ensemble* of the system were immoveable. In order to give the enunciation of this important principle a rigorous precision requiring no qualification, it is necessary to conceive that all the points of the system describe equal and parallel straight lines at the same

time, and also that, whatever the velocity and direction of the general movement may be, it will not in the slightest degree affect the relative movements."

After discussing those three physical and fundamental laws of rational Mechanics, Comte gives an account of the chief divisions of the science.

The first and most important natural division of Mechanics consists in distinguishing two orders of questions, according as the subject of inquiry is "the conditions of equilibrium," or "the laws of movement;" whence *Statics* and *Dynamics*. A mere reference to this division suffices to make the necessity of it directly understood. Besides the real difference which evidently exists between these two fundamental classes of problems, it is easy to conceive *à priori* that Statical questions, from their nature, must generally be much more easy to treat than questions of Dynamics. For in the first case, as has been justly said, we make *abstraction of the time;* that is to say, the phenomenon to be studied being necessarily instantaneous, we do not require to regard the variations which the forces of the system can undergo at different successive instants. It being, however, necessary to introduce the latter consideration into every dynamical question, it there forms a most fundamental element, and constitutes the principal difficulty.

It follows, from this radical difference, that when we treat Statics as a particular case of dynamics, the whole of the former corresponds only to by far the simplest part of the latter,—to that, namely, which relates to the theory of uniform movements.

The importance of this division is very clearly verified by the general history of the actual development of the human mind. We see, in fact, that the ancients had acquired a knowledge of some fundamental and very essential truths relative to equilibrium, both as to solids and fluids, as may especially be seen in the beautiful researches of Archimedes, although they were far from

possessing a truly complete science of rational statics. Of Dynamics, on the contrary, they were entirely ignorant, even of the most elementary kind; the creation of this altogether modern science being due to Galileo.

After this fundamental division, the most important distinction to be made in Mechanics consists in the separation, both in Statics and Dynamics, of the study of solids from that of liquids. The discussion of this division, which Comte considers as subordinate to the other, occupies the remainder of this introductory lecture on rational Mechanics. The subject of the 16th lecture is Statics generally, of the 17th Dynamics, and the 18th is devoted to the consideration of the general theorems of rational Mechanics.

We must not follow this analysis into minuter detail. Indeed, only the extreme importance of Mathematics in its position in the hierarchy of the Sciences can warrant the length to which it has already extended.

SECTION VII.

GENERAL CONSIDERATIONS ON ASTRONOMY.

THE history of man's knowledge, the gradual growth of his conceptions on the subject of the stars, would be the history of the human mind. In Astronomy, from its very simplicity, we see with greater distinctness the procession of human thought, from the time when the course of the stars seemed prophetic of man's destiny, and their wayward ever-varying configurations seemed to drag with them the strange vicissitudes of life, to the time when positive science ascertained the main laws of the heavenly mechanism. In it may be seen amusingly illustrated the *theological* tendency of interpreting all phenomena according to human analogies, the *metaphysical* tendency of arguing instead of observing—of substituting some logical deduction for the plain observation of a fact; and finally, the *positive* tendency of limiting inquiry to accessible relations, and rejecting as idle all speculation which transcends our means.

Comte has not only devoted some four hundred pages of his second volume to an exposition of the main points necessary to be understood in a philosophic survey of Astronomy, but has also devoted a separate work to the subject (*Treatise of Popular Astronomy*), justly considering this science as one eminently calculated to render familiar his views of positive Method. In the remarks which are now to follow, Comte himself must be understood as speaking; the sentences are translations, or analyses of what may be found in his work :—

And first, as to the possible extent of our sidereal knowledge.

Sight is the only one of our senses through which we can acquire a knowledge of celestial objects. Hence, the only qualities which can become known to us are their forms, their distances, their magnitudes, and their movements; and Astronomy, therefore, may properly be defined thus:—

It has for its object the discovery of the laws of the geometrical and mechanical phenomena presented to us by the heavenly bodies.

It is, however, necessary to add, that, in reality, the phenomena of *all* the heavenly bodies are not within the reach of scientific investigation.

Those philosophical minds who are strangers to the profound study of Astronomy, and even astronomers themselves, have not yet sufficiently distinguished, in the *ensemble* of our celestial investigations, between the *solar* point of view, as I may call it, and that which truly deserves the name of *universal*. This distinction, however, appears to me indispensable to mark precisely the line of separation between that part of the science which may be brought to a state completely perfect, and that which, without indeed being purely conjectural, must always remain in the stage of infancy, at least when contrasted with the first. The solar system, of which we form a part, evidently offers a subject of study whose boundaries are well marked; it is susceptible of a thorough examination, and capable of leading us to the most satisfactory conclusions. But the idea of what we call *the universe* is, on the contrary, necessarily indefinite, so that, however extensive we would suppose our well-grounded knowledge of this kind to become in the course of time, we should never be able to arrive at the true conception of the universe of stars. The difference is, at this moment, very striking indeed; for, with a solar astronomy in the high degree of perfection

acquired during the last two centuries, we do not even yet possess, in sidereal astronomy, the first and simplest element of positive inquiry,—the determination of the distances of the stars. Doubtless, we have reason for presuming (as I shall afterwards explain) that those distances will be determined, at least within certain limits, in the case of several stars; and that, consequently, we shall know divers other important elements, which theory is quite prepared to deduce from this fundamental given quantity, such as their masses, &c. But the important distinction made above will by no means be affected thereby.

In every branch of our researches, and in all their chief aspects, there exists a constant and necessary harmony between the extent of our intellectual wants, and the real compass, present or future, of our knowledge. This harmony is neither the result nor the sign of a final cause, as our common-place philosophers try to believe. It simply arises from this evident necessity:—on the one hand we have only need of knowing what can act upon and affect us, more or less directly; and on the other, it follows, from the very fact of there being such influencing agencies in operation, that we are thereby sooner or later supplied with a sure means of knowledge. This relation is made manifest in a remarkable manner in the case before us. The most complete study possible of the laws of the solar system of which we form a part, is of high interest to us, and we have succeeded in giving it an admirable precision. On the contrary, if an exact idea of the universe is necessarily interdicted to us, it is plain that this is of no real importance, except to our insatiable curiosity. The daily application of astronomy shows that the phenomena occurring within each solar system, being those which can alone affect its inhabitants, are essentially independent of the more general phenomena connected with the mutual action of the suns, almost like our meteorological phenomena

in their relation to the planetary phenomena. Our tables of celestial events, prepared long beforehand, on the principle of taking no account of any other world in the universe save our own, have hitherto rigorously tallied with direct observations, however minute the precision we introduce into them. This independence, so palpable, is completely explained by the immense disproportion which we are certain exists between the mutual distances of the suns, and the small intervals between our planets. If, as is highly probable, the planets provided with atmospheres, as Mercury, Venus, Jupiter, &c., are really inhabited, we may regard their inhabitants as in some shape our fellow-citizens, seeing that from this sort of common country there would necessarily result a certain community of thoughts, and even of interests, while the inhabitants of the other solar systems must be entire aliens to us.* It is therefore necessary to separate more profoundly than has hitherto been customary, the solar from the universal point of view,—the idea of the world from that of the universe; the first is the highest which we have been able actually to reach, and is, besides, the only one in which we are truly interested.

Hence, without renouncing all hope of obtaining some knowledge of the stars, it is necessary to conceive positive astronomy as consisting essentially in the geometrical and mechanical study of the small number of heavenly bodies which compose the *world* of which we form a part. It is only within these limits that astronomy, from its perfection, merits the superior rank which it now holds among the sciences.

And here Comte calls attention to a very important philosophical law, never distinctly recognised before his

* It would be wrong to allow this passage to pass without qualification; all considerations, astronomical and zoological, lead us to the conclusion that these planets are inhabited by beings totally unlike the inhabitants of our own.

enunciation of it—viz.: *That in proportion as the phenomena to be studied become more complex, they are, from their nature, susceptible of more extended and more varied means of exploration.*

In other words, the complexity of the phenomena implies a greater variety of sources through which they can be investigated. If man had a sense the less, the phenomena now perceived by that sense would be wanting to him; if he had a sense the more, he would perceive more phenomena. There is not, however, an exact compensation between the increase of difficulty and the increase of our resources, so that, notwithstanding this harmony, the sciences which refer to the most complex phenomena continue no less necessarily the most imperfect, in accordance with the encyclopædical scale established at the commencement of Comte's work. Astronomical phenomena, then, being the simplest, ought to be those for which the means of exploration are the most limited.

Our art of observing is, in general, composed of three different processes:

1st. *Observation*, properly so called—that is to say, the direct examination of the phenomenon, as it naturally presents itself.

2nd. *Experiment*—that is to say, the contemplation of the phenomena, more or less modified by circumstances artificially created by us, for the express purpose of a more perfect exploration.

3rd. *Comparison*—that is to say, the gradual consideration of a series of analogous cases in which the phenomena become more and more simplified.

The science of organised bodies, which embraces the phenomena the most difficult of access, is at the same time the only one that truly permits the union of the three modes. Astronomy, on the contrary, is necessarily limited to the first. And observation is there restricted to that of a single sense. All that it does—and it is all

that is required—is to measure angles, and reckon times elapsed. Observation, however indispensable, plays the most insignificant part in astronomy: it is Reasoning which forms incomparably the greatest portion of astronomical science, and this constitutes the prime basis of its intellectual dignity. It is our intelligence which constructs the greater number of astronomical phenomena, actual phenomena though they are. We neither, for example, *see* the figure of the earth nor the curve described by a planet.

The combination of these two essential characteristics —extreme simplicity of the phenomena, with great difficulty in their observation—is what makes astronomy a science so eminently mathematical. On the one hand, the constant necessity we are under of deducing from a small number of direct measures, both angular and horary quantities, which are not themselves immediately observable, renders the continual use of abstract mathematics absolutely indispensable. On the other hand, astronomical questions being always problems of geometry or problems of mechanics, naturally fall within the province of concrete mathematics. And finally, not only as respects the geometrical problems do we have perfect regularity of astronomical figures, but, as respects the mechanical, we have admirable simplicity of movements taking place in a medium whose resistance has hitherto been left out of account without error, and under the influence of a small number of forces constantly subject to one very simple law; and these circumstances allow the application of the methods and the theories of Mathematics to a much greater extent than in any other case. There is perhaps not a single analytical process, a single geometrical or mechanical doctrine, which is not ultimately made use of in astronomical investigations, and the greater part of them have hitherto served no other primary purpose. Hence it is pre-eminently by a proper study of this application of

them that we can acquire a just sentiment of the importance and the reality of mathematical speculations.

Reflecting on the singularly simple nature of astronomical researches, and the consequent facility of applying the whole of our mathematical resources to them in the most extensive way, we understand why astronomy is now placed at the head of the natural sciences. It merits this supremacy—1st. By the perfection of its scientific character; 2nd. By the preponderating importance of the laws which it discloses to us.

After referring to several examples of the high practical utility of astronomy, Comte takes this science as an illustration of the fact, that the sublimest scientific speculations often, without premeditation, lead to the most ordinary practical and useful purposes, and he exposes the folly of those who would interdict all speculations except those which have obviously an immediate practical object in view.

On a closer examination of the present condition of the different fundamental sciences, we shall find that astronomy is the only one which is really and finally purged of all theological or metaphysical considerations. As respects Method, this is the first title it has to supremacy. It is there philosophical minds can effectually study in what a true Science really consists; and it is after this model that we ought to strive, as far as possible, to construct all the other fundamental sciences, having at the same time due regard to the differences, more or less profound, which necessarily result from the increasing complication of the phenomena.

Those who conceive Science as consisting of a simple accumulation of observed facts, have only to consider astronomy with some attention to feel how narrow and superficial is their notion. In it the facts are so simple, and of so little interest, that one cannot possibly fail to observe that only the connexion of them and the exact

knowledge of their laws, constitute the science. What, in reality, is an astronomical fact? Nothing else, ordinarily, than this: a star has been seen at a particular instant, and under a correctly measured angle; a circumstance, doubtless, of little importance in itself. The continual combination of these observations, and the more or less profound mathematical elaboration of them, characterize the science even in its most imperfect state. In reality, astronomy did not take its rise when the priests of Egypt or Chaldea had, with more or less exactness, made a series of empirical observations on the heavens, but only when the first Greek philosophers began to connect the general phenomenon of the diurnal movement with certain geometrical laws. The true and definite object of astronomical investigations always being to predict with certainty the actual state of the heavens at a future period, more or less distant, the establishment of the laws of the phenomena evidently affords the only means of arriving at this result; the accumulation of observations cannot, of itself, be of any practical utility except as furnishing a solid foundation to our speculations. In one word, a true astronomy did not exist so long as mankind knew not, for example, how to foresee, with a certain degree of precision, by the aid at least of graphical process, and in particular by certain trigonometrical calculations, the instant of the rising of the sun, or of a star, on a given day and at a given place. This essential characteristic of the science has always been the same since its origin. All the steps in its subsequent progress have only consisted in giving to these predictions a greater and greater certainty and precision, by borrowing from direct observation the least possible number of given terms for the purpose of foreseeing the most distant future. No part of philosophy can manifest with greater force the truth of this fundamental axiom: *every science has prevision for its object;*

which distinguishes real science from simple erudition, limited to the narrative of past events without any view to a future.

Not only is the true characteristic of a science more decidedly marked in astronomy than in any other branch of positive knowledge, but we may even say, that since the development of the theory of gravitation, it has attained the highest degree of philosophical perfection that any science can ever pretend to, as respects Method,—the exact reduction of all phenomena, both in kind and in degree, to one general law,—provided always that we confine the remark to solar astronomy. The gradual complication of phenomena may lead us to conceive a similar perfection as absolutely chimerical in the other fundamental sciences. But it is the general type which all men of science ought constantly to have in view, as being the one to which they must approximate as far as the corresponding phenomena will allow. It is in astronomy that we perceive in all its purity what the positive *explanation* of a phenomenon is, without any inquiry as to the first or final cause of it; and, finally, it is there we must learn the true character, and the essential conditions, of truly scientific *hypotheses*, no other science having employed this powerful instrument so extensively, and at the same time so fittingly.

SECTION VIII.

ASTRONOMY AND RELIGION.

It need scarcely be remarked that many interesting details must necessarily be omitted in this analysis, in order not to extend it to a length incompatible with its introductory character. To complete what is indispensable to be said on the subject of Astronomy, it will be enough to indicate—1st, the division of the science, 2nd, its hierarchical position, and, 3rd, its illustration of the doctrine of *final causes*.

In Mathematics, Comte establishes, as we have seen, the two capital divisions of Geometry and Mechanics: the one treating of space and the forms of things occupying space — *i. e.* treating of lines, surfaces, and solids, straight or curved; the other treating of motion and its laws. Astronomy is, par excellence, a mathematical science; indeed, it may be called *applied* mathematics; and it forms the link between general Mechanics and terrestrial Physics, for it is simply a science of spaces, figures, and motion, brought down from the region of pure abstraction into that of reality by the introduction of a real agent—gravitation.

Astronomy, conformably with its mathematical structure, has also two capital divisions—1st. *Geometrical Astronomy,* or celestial geometry, which, from its having possessed a scientific character so long before the other, still preserves the name of astronomy, properly so called; 2nd. *Mechanical Astronomy,* or celestial mechanics, of which Newton was the immortal founder, and which has received so vast and so admirable a development within the last century.

In astronomy, properly so called, we have only to determine the form and magnitude of the heavenly bodies, and to study the geometrical laws according to which their positions vary, without considering these changes of position in relation to the forces which produce them; or, in more positive terms, to the elementary movements on which they depend. Thus was it able to make, and actually did make, the most important progress before celestial mechanics began to exist; and even since that time, its most remarkable discoveries have been due to its own spontaneous development, as may be seen in the beautiful work of the great Bradley on *Aberration and Nutation.* Celestial mechanics, on the contrary, are, from their nature, essentially dependent on celestial geometry, without which they could not possess any solid foundation. Their object, in fact, is to analyze the actual movements of the stars, so as to connect them, according to the rules of rational mechanics, with the elementary movements governed by an universal and invariable mathematical law; and proceeding from this law, to bring our knowledge of the real movements to a high degree of perfection, by determining them, *à priori,* from the calculations of general mechanics, —taking the least possible number of terms from direct observation, but yet always verifying them by it. It is thus that is established, in the most natural way, the fundamental bond between astronomy and physics, properly so called; a connexion now become definite, that several great phenomena form an almost insensible transition from the one to the other, as we see particularly in the theory of tides. But it is evident that what gives to celestial mechanics all their reality, is, their having started from the actual knowledge of real movements, furnished by celestial geometry. It is precisely from their not having been conceived in accordance with this fundamental relation, that all the attempts made before Newton to form systems of celestial mechanics,—and,

among others, that of Descartes, — were necessarily illusory in a scientific point of view, however useful they may have been at the time under the philosophical aspect.

The position of Astronomy in the hierarchical scale is so evidently the position given to it by Comte, that all readers will with him regard the title chosen by Newton for his great work as a trait of philosophic insight: *Philosophiæ naturalis principia mathematica.* Newton thus concisely pointed out that the general laws of celestial phenomena are the prime basis of the entire system of human knowledge.

Moreover, Astronomy stands first in virtue of its absolute *independence* of all other phenomena. It stands aloof. It is in no way subordinated to any physical, chemical, or physiological phenomena. But, on the contrary, it is certain that physical, chemical, physiological, and even social phenomena, are essentially subordinate to astronomical phenomena, in a more or less direct manner, independently of their mutual co-ordination. The study of the other fundamental sciences can therefore only possess a truly rational character, when it is preceded by an accurate knowledge of the astronomical laws referring to the most general phenomena. How can the mind apprehend any terrestrial phenomenon, in a really scientific manner, without in the first place considering what that earth is in the system of which we form part,—seeing that its position and its movements necessarily exercise a preponderating influence on all which happens in it? What must our physical conceptions be, and, as a consequence, our chemical and our physiological, without the fundamental notion of gravitation, which overrules them all? To choose the most unfavourable example, where the subordination is the least apparent, we must admit, although at first it may appear strange, that even those phenomena which relate to the development of human society could not be con-

ceived in a rational way without a previous consideration of the principal laws of astronomy. We may easily become sensible of this, by observing that if the different astronomical elements of our planet, and as its distance from the sun, and the consequent duration of the year, the obliquity of the ecliptic, &c., were to undergo any important changes,—(a result which in astronomy would have scarcely any other effect than that of modifying certain co-efficients,)—our social development would doubtless be notably affected, and even become impossible, if ever these alterations were to pass beyond a certain point. Comte is not afraid of meriting the reproach of exaggeration by saying that social physics did not become possible as a science, until geometricians had demonstrated that the derangement of our solar system could never extend beyond gradual and very limited oscillations about a mean state necessarily invariable.

That man would have a very imperfect idea of the high intellectual importance of the theories of astronomy, who limited his view to their necessary and special influence on the different parts of Natural Philosophy. He must also consider the general effect which they directly have on the fundamental tendencies of our intelligence, to the renovation of which the progress of astronomy has contributed more powerfully than that of any other science.

Consider only the religious aspect of Astronomy, and the truth of the foregoing remark will stand out; and here, while concurring with all Comte says on the connexion between our astronomical knowledge and the whole series of conceptions on other subjects, I feel called upon to express the most decided and unequivocal dissent from his views on the connexion between Astronomy and Religion. What he says about *final causes*, every genuine Baconian will accept; but what he says about astronomy destroying religion, can only be accepted

by those who identify Religion with the *theologies* which from time to time obscure the true formula.

"To those who are strangers to the study of the heavenly bodies, although frequently masters of the other parts of natural philosophy, astronomy has still the reputation of being an eminently religious science, as if the famous verse: *The heavens declare the glory of God,* still preserved all its value. To minds early familiarized with true philosophical astronomy, the heavens declare no other glory than that of Hipparchus, of Kepler, of Newton, and of all those who have aided in establishing their laws. It is, however, certain, as I have shown that all real science is in radical and necessary opposition to all theology, and this characteristic is more decided in astronomy than anywhere else, just because astronomy is, so to speak, more a *science* than any other, according to the comparison made above. No other has given more terrible shocks to the doctrine of final causes, generally regarded by the moderns as the indispensable basis of every religious system, although, in reality, it has only been a consequence of them. The simple knowledge of the movement of the earth must have destroyed the prime and real foundation of this doctrine, the idea of the universe subordinated to the earth, and consequently to man,—as I shall specially explain when treating of this movement. Besides, the accurate exploration of our solar system could not but dispel that blind and unlimited wonder which the general order of nature inspired, by showing, in the most sensible manner, and in various respects, that the elements of this system are *certainly not disposed in the most advantageous manner,* and that *science permits us easily to conceive a happier arrangement.* Finally, under a last and still more important point of view,—by the development of true celestial mechanics since Newton, all theological philosophy, even the most perfect, lost for ever its principal intellectual function,

—the most regular order being thenceforth conceived as necessarily established and maintained in our world, and in the entire universe itself, by the simple mutual gravity of its different parts."

In reference to this doctrine of final causes, Comte remarks, that much eloquent declamation might be spent on the great idea of the essential stability of our solar system, and yet it is a simple and necessary consequence of certain characteristics of that system,—the extreme smallness of the planetary masses in comparison with the central mass, the slight degree of eccentricity of their orbits, and the moderate mutual inclination of their planes. Besides, from the very fact that we *do* exist, we ought, *à priori*, to expect to find a *disposition of matter, such as would permit of that existence*,—which would be incompatible with the total want of stability. The alleged final cause amounts to this childish remark: that there are no inhabited planets in our solar system, except those that are habitable. In a word, we land at the principle of the *conditions of existence*, which is the true positive transformation of the doctrine of final causes, and which is much the superior to it in range and fecundity.

Let me call attention to the one fundamental and extremely vicious assumption which lies at the basis of this unphilosophical outbreak against the grand old Hebrew phrase, so potent with rhythmic meaning, "The heavens declare the glory of God." The assumption is one which may be found lurking in every theology and metaphysic which ventures into the arena of debate; and because it is begotten of intellectual pride, it will long be cherished by the intellect. The assumption is, That what *we* can conceive as the Perfect, must necessarily *be* the Perfect. In other words, it is the old sophistic canon of "Man the measure of all things." I repudiate this with all my soul and with all my strength; and label it as the last refinement of

the Anthropomorphic tendency in the human mind—a tendency which, in the earlier epochs of Humanity invested gods with the Passions, and Caprices, no less than with the Reason of man. At all times man has made God in his own image; he has idealized and intensified his own nature, and worshipped that. This he has ever done; this, perhaps, he ever will do. But we, who in serene philosophy smile condescendingly on the ill-taught barbarian whom we find attributing his motives, his passions, his infirmities to the Creator of all, we who "shudder" at the idea of such anthropomorphism, how comes it that we also have fallen into the trap, and having withdrawn from God the investiture of Passion, persist in substituting for it an abstraction named Reason? The assumption is that God is pure Reason—omnipotent Intelligence; and as intelligence is Lord and Master of this Universe, so, whatever *our* Intelligence recognises as perfect or imperfect, must *be* perfect or imperfect!

This anthropomorphism is active in almost all speculators. What they seek in the universe is not Life, but "evidences of design!" If they can but make out the presence of a "skilful Designer," they believe they have done everything. With a mechanical theory of the universe, they demand proof of the existence of a great Mechanician who "contrives" so adroitly (it being necessary for Omnipotence to "contrive!") and having proved *that*, all is said! I do not hesitate to declare my preference of the primitive spontaneous conceptions of the Deity, (which gave him at least the grand idealization of the *totality* of our nature), to this weak abstraction of a *part* of our nature—this deification of Intellect. I would rather worship Jupiter than the metaphysician's "Reason."

But if I object to that metaphysical aberration named "Natural Theology," founding its pretensions not on the true and devout interpretation of Nature, but on its

interpretation of "contrivance" and "design," which *it* is clever enough to detect, and to applausively appreciate; still more do I object to Comte's unwarrantable and (strange accusation!) equally *metaphysical* assumption couched in that phrase, "science permits us easily to conceive a happier arrangement." Science permits it! Wherefore is Science to be final arbiter in questions wholly beyond its competence? *We* can conceive simpler arrangements; does it therefore follow that our simpler conceptions would be *better?* What is simplicity, but a human convenience, and how is it better *in esse* than complexity? It would seem to us *simpler* to have no serpents, no lions, no crocodiles, no fleas; but what would those serpents, lions, crocodiles, and fleas say to such simplicity? It would be simpler for man to be born at once and immortal; but what has philosophy to do with such simplicity?

I agree with Comte that the pretended beauty of "design" manifested in astronomy is not a legitimate argument, but protest against his asserting that the elements of our universe are not arranged in the most advantageous manner, and that science could better have arranged them. With Lafontaine let us say:—

> "C'est dommage Garo que tu n'es point entré,
> Aux conseils de Celui que prêche ton curé:
> Tout aurait été mieux."

Science has no knowledge of these things;* to assume such a competence is to assume that "man is the measure of all," and that Intellect is the final arbiter of Life.

Astronomy has destroyed theologies; and it must

* Metaphysics is the science of things which cannot be known; or, as some one wittily said, *l'art de s'égarer avec méthode;* and the assumption referred to above assuredly belongs to this futile ingenuity.

destroy every false theology. It must destroy it, if only by its emphatic condemnation of the capital point in all our theological systems,—viz., the subordination of the Universe to man. When the sun was regarded as a light to rule over the day, and the stars as only lesser lights, it was natural enough for man to suppose them created solely for his use. But that conception is no longer tenable. Now that man knows what a mere speck is his World in the awful Universe of Worlds, he feels *himself* to be more insignificant; and, accompanying this feeling, the grander conception of the Universe and of God emerges eminent in his soul.

I say, therefore, that if astronomy must destroy theology, it will not destroy, it will deepen Religion. There is no man in whom the starry heavens have not excited religious emotion; no man sweeps the heavens with his telescope without religious emotion; whatever may be the litanies most suitable to his mind, under some form or other man cannot help worshipping when under this canopy of the "Cathedral of Immensity." However various the dialects and formulas into which the emotion may be translated, according to the various intellects of men, the emotion itself is constant; and the Last Man, gazing upwards at the stars, will, in the depths of his reverent soul, echo the Psalmist's burst—

THE HEAVENS DECLARE THE GLORY OF GOD!

SECTION IX.

THE SCOPE AND BEARING OF PHYSICS.

PHYSICS, literally the science of Nature, are restricted to what, in ordinary language, is loosely termed Natural Philosophy. As the second of the Fundamental Sciences we have now to examine their position and bearing in Positive Philosophy. Astronomy and Sociology stand as the Alpha and Omega of Science: the one setting forth the laws of heavenly bodies, the other setting forth the laws which regulate the great movements of Humanity. Between these stand Physics, setting forth as much as may be known of the mystery of this earth, and Physiology (or, more accurately, Biology) as much as may be known of Organic Life. In an inner centre, closely, nay inseparably, connected with both, stands Chemistry, or the science of molecular action. Thus is the circle complete.

One need scarcely say that all such divisions are arbitrary. Nature admits of no distinct lines of demarcation. You cannot say, Here ends the inorganic world, and here begins the organic; you cannot say, Here we see the vegetable domain cease, and here the animal commence; but you can and do say, This rose is a plant, This lion is an animal. Therefore, although Chemistry is inseparable from Physics, and Biology is inseparable from Chemistry, when analysis conducts us to ultimate principles, yet demarcations, such as those just hinted, are necessary and convenient.

Physics did not (according to Comte) begin definitely to disengage itself from Metaphysics, and take a truly positive character, until after the great discoveries of

Galileo on the fall of heavy bodies; whereas Astronomy was really positive, under the geometrical point of view, from the period of the foundation of the School of Alexandria. Here, therefore, we ought not only to look for the direct influence of greater complication in the phenomena, but also expect to find the scientific condition of Physics much less satisfactory than that of Astronomy, as well under the speculative point of view, in respect of the purity and the co-ordination of their theory, as under the practical point of view, in regard to the extent and exactness of the predictions which result from them. In truth, the gradual formation of this science during the two last centuries was owing to the philosophical impulse of the precepts of Bacon, and the conceptions of Descartes, which necessarily made its general progress much more rational, by directly establishing the fundamental conditions of the universal Positive Method. But, however important this great power may have been in accelerating the natural progress of physical philosophy, the long dominion of primitive metaphysical habits was so absolute, and the positive spirit,—which only use could develope,—remained so imperfectly characterised, that this science could not in so short a time acquire complete positivism—a state not attained by astronomy itself, as respects the mechanical part of it, before the middle of this period.

Thus, starting from the point where our philosophical examination has now arrived, we find, in the different fundamental sciences remaining for our consideration, more and more profound traces of the metaphysical spirit from which astronomy, alone of all the branches of natural philosophy, is completely freed. This anti-scientific influence will not be found limited to details of slight importance. We shall find that it notably alters the fundamental conceptions of science, which has not, even in the case of physics, yet taken entirely its definite philosophical character.

And first, as to the extent of the domain of the science of Physics.

Like Chemistry, Physics have for their object the discovery of the general laws of the Inorganic world. The study of these laws is completely distinct from that of the Science of Life, as from that of Astronomy, which is confined to the consideration of the forms and movements of the great bodies of nature. But the distinction (a real and indispensable one) between Physics and Chemistry is less precisely marked, and modern discoveries are rendering it still more difficult. There are, however, three general considerations which, taken together, make the division between the two sciences quite distinct.

The first consists in the characteristic connection between the necessary *generality* of truly physical questions, and the *speciality* no less inherent in investigations purely chemical. Even the philosophers of the seventeenth century had some glimpse of this. All the conceptions of physics, properly so called, are more or less applicable to all bodies whatever; while, on the contrary, every chemical idea necessarily relates to an action peculiar to certain substances, whatever resemblances we may otherwise find between the different cases. This fundamental contrast between the two categories of phenomena is always distinctly marked. Weight, for example, is shown in all bodies; so also are the phenomena of thermology, acoustics, optics, and even of electricity; there being only an inequality of degree in their manifestation. The compositions and decompositions of chemistry, on the other hand, show radically *specific* properties, varying both in elementary and compound substances. The apparent exception to the generality of physical studies, in the case of magnetism, was dispelled by the discovery of its phenomena being only modifications of the undeniably general phenomena of electricity.

The second elementary consideration distinguishing Physics from Chemistry is of less importance, and indeed it rests on less firm grounds than the preceding one, although susceptible of being turned to proper use. It consists in this, that the *phenomena considered in physics refer to the masses, and in chemistry to the molecules*; whence the habitual denomination of *molecular physics*, formerly given to the latter science.

But purely physical phenomena are often molecular. The weight of a mass, for example, is the total weight of all the separate molecules in it. Again, in chemistry, a certain mass is required to exhibit chemical action. Still there is much truth in the distinction. In order to produce chemical phenomena, one, at least, of the bodies between which the chemical action is to take place, must be in a state of extreme division, and even, most frequently, in a state of true fluidity; and without this, the action will not be produced: while, on the contrary, this preliminary condition is never indispensable to the production of any physical phenomena, properly so called, but is even a circumstance always unfavourable to it, although it is not sufficient constantly to prevent it.

Finally, we may thus distinguish physical phenomena from chemical. In the former, the constitution of the bodies—that is to say, the mode of arrangement of their particles—may change; their nature—that is to say, the composition of their molecules—remains constantly unalterable. In the latter, on the contrary, not only is there always a change of state as respects some one of the bodies in question, but the mutual action of these bodies necessarily alters their nature: and it is a modification of this sort which essentially constitutes the phenomenon. The greater number of the agents considered in physics are doubtless susceptible, when their influence is very energetic

or very prolonged, of effecting, by themselves, some compositions and decompositions perfectly identical with chemical action, properly so called; and this is the reason why there is so natural and so direct a connexion between Physics and Chemistry. But here the phenomena pass from the domain of the first science, and enter that of the second.

The preceding considerations suffice to furnish a precise definition of the proper object of Physics, when strictly circumscribed within their natural limits. In Physics *we study the laws which govern the general properties of bodies ordinarily viewed in their mass, and constantly placed in circumstances capable of maintaining intact the composition of their molecules, and most frequently even their state of aggregation.* To act up to the true spirit of philosophy, we always require that every science worthy of the name have for its aim, the establishing, on sure grounds, of a *corresponding order of predictions.* In order, therefore, to complete the definition, it is indispensable to add, that the ultimate object of the theories of physics is *to foresee, as exactly as possible, all the phenomena which may be presented by a body placed in any given circumstances,* excluding always those which could alter its nature. It is not to be doubted that this end is rarely attained in a complete and perfectly precise manner; but this is only because the science is imperfect. Were its actual imperfection much greater than it is, such would still be its necessary destination.

From this simple and summary exposition of the general object of physical investigations, it is easy to perceive that they necessarily present greater complexity than astronomical studies. The latter are limited to the two most simple and elementary aspects of the bodies there considered,—namely, their *forms* and their *movements.* In Physics, on the contrary, the bodies are accessible to all our senses,—the general conditions

which characterise their actual existence are considered, and they are studied under a great number of different and mutually complicated relations. Physics must inevitably be less perfect than Astronomy; and were it not for the extension of the means of exploration in the former, in accordance with the law mentioned in a previous section,—the increased imperfection of Physics might be conceived, *à priori*, as rendering a science impossible. The method of Comparison is not more applicable in Physics than in Astronomy; but it is otherwise with Experiment. Observation (no longer confined to that of a single sense) and Experiment have their most complete development in Physics. In Organic Physics, it is impossible to obtain the requisite conditions of a perfect experiment. The freedom of choice of the example (whether natural or artificial) best fitted to manifest the phenomena, constitutes the chief characteristic of the art of philosophical Experiment; and this freedom is found more in Physics than in Chemistry. It is to the development of Physics that the creation of the art of Experiment is due.

Next to the rational use of the Experimental Method, the application, more or less complete, of Mathematical Analysis forms the principal basis on which the perfection of Physics rests. It is here that the actual range of this Analysis in natural philosophy finds its limit; and in the sequel of Comte's work it is shown how chimerical it would be to expect that its domain will be further extended, even to Chemistry, with any real efficacy. The comparative fixity and simplicity of physical phenomena ought naturally to permit an extensive employment of Mathematics, although they are much less adapted to physical than to astronomical studies. This application may occur under two very different forms,—the one direct, the other indirect. The first takes place when the phenomena are such as to permit of our immediately finding in them a *fundamental numerical law*, which

becomes the basis of a more or less prolonged series of analytical deductions; as in the eminent example of Fourier when he created his beautiful mathematical theory of the distribution of caloric, founded altogether on the principle of the *thermological action between two bodies being proportional to the difference of their temperatures*. Most frequently, on the contrary, mathematical analysis is introduced only indirectly; that is, after the phenomena have been connected with some geometrical or mechanical law by means of a course of experiment; and then, it is not to Physics, properly speaking, that the analysis is applied, but to geometry, or mechanics. Among other examples, we may cite the theories of reflection and of refraction, as respects geometry; and those of weight or of harmonics, as respects mechanics.

The application of mathematics to physics ought only to take place, and that with extreme circumspection, when assurance has been obtained of the *reality* of the physical facts from which the mathematical deductions are to be made. The neglect of this rule has occasioned numerous analytical labours founded on wild hypotheses or on chimerical conceptions, and has often converted physical studies into mere mathematical exercises. To avoid these evils, natural philosophers ought themselves to be familiar with as much of mathematics as would enable them to make the proper application of Mathematics to physics, instead of leaving it to mathematicians, destitute of true ideas on the nature of physical inquiry.

Comte—whose language has here been almost verbally employed—adds, that the services rendered by Mathematics to Physics have been immense. They have given to Physics that admirable precision and perfect co-ordination which always characterise their employment. But still, he remarks, they are less applicable to Physics than to Astronomy. In Physics, we have, more or less,

to overlook the essential conditions of the problem, and in so far to alter the actual nature of the phenomena, in order to permit the use of analysis; while, to ensure correctness and reality in physical studies, it is necessary to have recourse both to Experiment and Analysis,—checking and aiding the latter by the former, without subordinating the one to the other.

SECTION X.

ON THE INFLUENCE AND METHOD OF PHYSICS.

THE very destination of Positive Philosophy being that of influencing the whole intellectual system of man, who moves through life by its aid, Comte's summary indication of the part played by Physics in that action must not be omitted.

In the first place, its influence is necessarily less profound than that of the two terminal sciences, Astronomy and Biology. These two sciences standing at opposite extremes, directly determine our ideas respecting the two universal and correlative subjects of all our conceptions—the world and man; and hence, from their very nature, they must spontaneously influence human thought in a more decided way than can be done by the intermediate sciences, Physics and Chemistry, however indispensable the intervention of the two latter may be. The influence of Physics and Chemistry, however, on the general development and the definite emancipation of human intelligence, is nevertheless decided. To speak only of Physics, it is evident that the fundamental character of absolute opposition between positive philosophy and theology, or metaphysics, makes itself very strongly felt, although it is less complete than in the case of Astronomy, by reason of the inferiority of Physics in scientific perfection. For this comparative inferiority, of which vulgar thinkers are little sensible, we doubtless have a full equivalent, so far as the present question is concerned, in the much greater variety of the phenomena embraced by physics. In fact, the intellectual

59947

history of the few last centuries makes it manifest that this science has been the principal scene of the general and decisive struggle of the Positive spirit against the Metaphysical; in astronomy, the dissensionh as been less marked, and there positivism has triumphed almost spontaneously, except on the subject of the earth's movement.

There is another important fact to be noticed here. It is in Physics that *natural phenomena first begin to be really modifiable by human intervention.* This power of modification is impossible in astronomy; but we shall see it manifesting itself more and more in all the sciences of the encyclopedical series. If the extreme simplicity of astronomical phenomena had not necessarily permitted our carrying scientific prevision in their case to the greatest degree of exactness, it would have followed from the impossibility of our interfering in any way in their accomplishment, that their radical enfranchisement from all theological and metaphysical supremacy would have been a difficult process. But perfect prevision effectually served this end in a different way from the small virtual action of man upon all the other phenomena of nature. As respects the latter, on the contrary, this action, however limited it may be, obtains, by way of compensation, a high philosophical importance, on account of our inability to bring the rational prevision of them beyond a slight degree of perfection. The fundamental character of all theological philosophy is to *conceive phenomena as subjected to supernatural volition*, and, consequently, as eminently and *irregularly variable.* Now, the public cannot enter into any profound speculative discussion respecting the superiority of the different philosophical points of view; and those theological conceptions can only be subverted finally by means of these two general processes, whose popular success is infallible in the long run:

1. *The exact and rational prevision of phenomena;*

and 2. the *possibility of modifying them*, so as to promote our own ends and advantages.

The former immediately dispels all idea of any "directing volition;" and the latter leads to the same result under another point of view, by making us regard this power as subordinated to our own. The first process is the more philosophical, and most easily carries popular conviction with it, when it is completely applicable, which, however, has scarcely been the case hitherto, except with celestial phenomena; but the second, when its reality is very evident, meets no less necessarily with universal assent.

Illustrations will occur in abundance to any well-stored memory. I will mention, as an obvious and striking example, the destruction of the theological theory of thunder by Franklin's discovery. If man could thus take the lightning in his hand, and direct its course as he pleased, it could not long be believed to be the flashing wrath of a deity!

Passing from this topic to that of the Method of Physics, considered in their hierarchical position, Comte bids us remember that the speculative perfection of a science is to be principally measured by these two distinct but co-relative properties—*co-ordination* and *power of prevision*; the latter being the most decisive criterion, as it is the principal object of every science.

In the first place, whatever may be the future progress of Physics, they must evidently continue, under both points of view, very inferior to Astronomy, owing to the variety and complexity of their phenomena. In lieu of that perfect mathematical harmony and unity which we have admired in the science of the heavenly bodies, Physics present us with numerous branches almost completely isolated from each other, and having frequently no other than a feeble and equivocal connection between their principal phenomena. And then, instead of the rational and precise prevision of celestial events at any period whatever, made from a very small

number of direct observations, our foresight here is quite limited in its range, and, when certainty is desired, scarcely ever admits of our leaving present circumstances out of view.

For similar reasons, the speculative superiority of Physics over the rest of natural philosophy is equally incontestable. We may also observe that the philosophical study of Physics, regarded as a general means of intellectual education, possesses a special utility, not to be found elsewhere to the same extent; it enables us completely to apprehend the fundamental art of Experiment, which is particularly adapted to physics. It is there that true philosophers, whatever the peculiar object of their habitual pursuits, must always learn what constitutes the true experimental spirit; what are the characteristic conditions requisite in experiments which are capable of showing unequivocally the actual laws of phenomena; and finally, how to form a just conception of the ingenious precautions by which we may prevent any interference with the results of a process of such delicacy. Every one of the fundamental sciences presents the essential characteristics of the Positive Method, which are necessarily manifested in them in a degree more or less decided: but besides this, each of them as naturally shows some philosophical indications belonging peculiarly to itself, as we have already remarked in the case of astronomy; and it is always at their source that such conceptions of universal logic ought to be examined.

It is to Mathematics alone that we are indebted for our knowledge of the elementary conditions of positivism. Astronomy characterises with precision the true study of nature; Physics specially present us with the theory of Experiment; it is from Chemistry that we must borrow the general art of Nomenclature; and finally, the science of Organised Bodies can alone unfold to us the true theory of Classifications.

Newton's assertion, *Hypotheses non fingo*—I make no

hypothesis,—has been incessantly repeated by men who fancy themselves Baconian thinkers when they restrict their incompetence to what they call "facts." No reader of these pages need be told that such ideas of science are utterly irrational. Newton himself gives it no countenance. His own great discovery was an Hypothesis at first, and only became a Theory after verification. Kepler made nineteen hypotheses respecting the form of the planetary orbits, and abandoned them one by one, till he settled on the elliptical form, which, on verification, proved correct, and *then* was no longer an hypothesis.

Every one who has made any original scientific researches must have a vivid sense of the indispensable utility of Hypothesis as an artificial aid, accompanied by an equally vivid sense of the necessity of distinctly understanding its purpose and limits; and to this end I emphatically urge the reader to study what Comte and John Stuart Mill (*Logic*, book iii. ch. xiv.) have written on the subject. Mill's *Logic* the reader has, or ought to have, at hand. Comte teaches thus:—A law of nature can only be discovered by Induction or Deduction. Often, however, neither method is of itself sufficient without our previously making temporary suppositions regarding some of the very facts of which we are in search. This indispensable mode of proceeding has been most fruitful in its results; but, from neglect of the condition on which it can be rightly used, the progress of true science has been much obstructed. This condition, but vaguely analysed as yet, may be thus stated:—that we must never imagine any hypotheses which *are not by nature susceptible of a positive verification* sooner or later, and which shall have exactly that degree of precision ascertainable in the study of the corresponding phenomena. In other words, truly philosophical hypotheses must always present the character of *simple anticipations of what experience and reasoning are*

capable of at once discovering when the circumstances of the problem are more favourable.

But if we would pretend to attain, by means of an Hypothesis, anything that is in its nature altogether inaccessible to observation and to reason, we should overlook the fundamental condition of all Hypothesis; and our supposition, transcending the real sphere of science, would become misleading and dangerous.

It would become dangerous, because every positive thinker agrees that our scientific inquiries are restricted to the analysis of phenomena, to discover their *Laws*, and in no sense to discover their *Causes*, essential or final. And how should a pure supposition, such as an Hypothesis, be possessed of a deeper plummet line to fathom the unfathomable? Therefore every hypothesis which traverses the limit of positive science can only lead to interminable discussion, never to solid agreement.

The different hypotheses still employed by natural philosophers are clearly distinguishable into two classes: the one, as yet small in extent, simply refers to the laws of the phenomena: the other, which plays a much more extended part, relates to the determination of the general agents supposed to produce the different kinds of phenomena. Now, according to the rule just laid down, the first class is alone admissible; the second, essentially chimerical, has an anti-scientific character, and can only obstruct the real progress of physics. In astronomy, the first kind of hypothesis is alone employed; the use of the second was long ago exploded. We no longer suppose the existence of chimerical *fluids* to explain the movement of the heavenly bodies. Why, then, in physics use hypotheses without the requisite precautions, and imagine fluids and ethers, invisible, intangible, imponderable, and inseparable from the substances to which they impart their virtues, in order to explain the phenomena of heat, light, electricity, magnetism? The very fact that the existence of these pretended fluids is,

from their nature, incapable of negation or affirmation, shows that they are beyond the reach of positive control. You might as well admit the existence of the elementary spirits of Paracelsus, of angels, and of genii! The assumption of these Entities in science, so far from helping to *explain* phenomena, has the very reverse effect; it increases the number of things requiring explanation. For whence come the properties of these fluids? On what do they depend? It is evident that *they* demand explanation as much as the phenomena they are introduced to explain; they are the tortoise-back upon which the Indian's world is supposed to rest! Newton could not conceive attraction otherwise than through the agency of an ether. No one believes in that attracting medium now; yet men of science, especially in England, will be up in arms at the heresy of supposing light, heat, or electricity, can be robbed of their mysterious fluid! Because it will sound heretical, I strengthen Comte's position by the following passage from John Mill:—

"The prevailing hypothesis of a luminiferous ether I cannot but consider, with M. Comte, to be tainted with the same vice. It can never be brought to the test of observation, because the ether is supposed wanting in all the properties by means of which our senses take cognizance of external phenomena. It can neither be seen, heard, smelt, tasted, nor touched. The possibility of deducing from its supposed laws a considerable number of the phenomena of light is the sole evidence of its existence that we have ever to hope for; and this evidence cannot be of the smallest value, because we cannot have, in the case of such an hypothesis, the assurance that if the hypothesis be false it must lead to results at variance with the true facts.

"Accordingly, most thinkers of any degree of sobriety allow, that an hypothesis of this kind is not to be received as probably true because it accounts for all the known phenomena; since this is a condition often ful-

filled equally well by two conflicting hypotheses; and if we give ourselves the license of inventing the causes themselves as well as their laws, a person of fertile imagination might devise a hundred modes of accounting for any given fact, while there are probably a thousand more which are equally possible, but which, for want of anything analogous in our experience, our minds are unfitted to conceive. But it seems to be thought that an hypothesis of the sort in question is entitled to a more favourable reception, if, besides accounting for all the facts previously known, it has led to the anticipation and prediction of others which experience afterwards verified; as the undulatory theory of light led to the prediction, subsequently realized by experiment, that two luminous rays might meet each other in such a manner as to produce darkness. Such predictions and their fulfilment are, indeed, well calculated to strike the ignorant vulgar, whose faith in science rests solely on similar coincidences between its prophecies and what comes to pass. But it is strange that any considerable stress should be laid upon such a coincidence by scientific thinkers. If the laws of the propagation of light accord with those of the vibrations of an elastic fluid in as many respects as is necessary to make the hypothesis a plausible explanation of all or most of the phenomena known at the time, it is nothing strange that they should accord with each other in one respect more. Though twenty such coincidences should occur, they would not prove the reality of the undulatory ether; it would not follow that the phenomena of light were results of the laws of elastic fluids, but at most that they are governed by laws in some measure analogous to these; which, we may observe, is already certain, from the fact that the hypothesis in question could be for a moment tenable. There are many such harmonies running through the laws of phenomena in other respects radically distinct. The remarkable resemblance between the laws of light

and many of the laws of heat (while others are as remarkably different,) is a case in point. There is an extraordinary similarity running through the properties, considered generally, of certain substances, as chlorine, iodine, and brome, or sulphur and phosphorus; so much so that when chemists discover any new property of the one, they not only are not surprised, but expect to find that the other or others have a property analogous to it. But the hypothesis that chlorine, iodine, and brome, or that sulphur and phosphorus, are the same substances, would, no doubt, be quite inadmissible.

"I do not, like M. Comte, altogether condemn those who employ themselves in working out into detail this sort of hypotheses; it is useful to ascertain what are the known phenomena to the laws of which those of the subject of inquiry bear the greatest, or even a great analogy, since they may suggest (as in the case of the luminiferous ether it actually did) experiments to determine whether the analogy which goes so far does not extend still further. But that in doing this, men should imagine themselves to be seriously inquiring whether the hypothesis of an ether, an electric fluid, or the like, is true; that they should fancy it possible to obtain the assurance that the phenomena are produced in that way, and no other; seems to me, I confess, as unworthy of the present improved conceptions of the methods of physical science, as it does to M. Comte. And at the risk of being charged with want of modesty, I cannot help expressing astonishment that a philosopher of the extraordinary attainments of Mr. Whewell should have written an elaborate treatise on the philosophy of induction, in which he recognises absolutely no mode of induction except that of trying hypothesis after hypothesis until one is found which fits the phenomena; which one, when found, is to be assumed as true, with no other reservation than that if on re-examination it should appear to assume more than is needful for ex-

plaining the phenomena, the superfluous portion of the assumption should be cut off. It is no exaggeration to say, that the process which we have described in these few words, is the beginning, middle, and end of the philosophy of induction as Mr. Whewell conceives it. And this without the slightest distinction between the cases in which it may be known beforehand that two different hypotheses cannot lead to the same result, and those in which, for aught we can ever know, the range of suppositions, all equally consistent with the phenomena, may be infinite."

Comte clearly shows how this conception of Ethers is only a remnant of the Metaphysical stage; and remarks that the metaphysical origin of this false method of proceeding can be easily detected by every impartial inquirer who will consider the *fluids* as having taken the place of the *entities*, the transformation of the latter being simply by *materializing* them. What, in reality (put what interpretation on it we will), is Heat, conceived as existing apart from the heated body? Light, independent of the luminous object? Electricity, separated from the electrical body? These are evidently nothing but pure Entities,—just as much as Thought is, when considered as possessing an existence independent of the thinking body; or Digestion when isolated from the digesting body! The only difference distinguishing them from these ancient scholastic Entities is this, that these essentially abstract existences have been replaced by imaginary fluids, whose corporeity is very equivocal, since, by their essential definition, we deprive them of all qualities capable of characterising any kind of matter whatever. Indeed, we do not even leave room for our regarding them as the ideal limit of a gas indefinitely rarefied.

It may serve perhaps to clear up some of the confusion darkening this subject, if I allude to a distinction necessary to be made in treating of the hypothesis of a

luminiferous ether. The undulatory hypothesis as regards the *process*,—i. e. as a Method or path along which the phenomena travel, is not only admissible, it is admirable; but in saying this, we do not imply an admission of the hypothesis of the *existence* of an Ether whose undulations produce light. The phenomena of light may be due to undulations; but that they are undulations of an Ether cannot be proven, unless the existence of the Ether itself can be proven, and by the very terms of its definition we *cannot* prove an Ether.

The fundamental character of metaphysical conceptions is to look on phenomena as independent of the objects which manifest them, and to attribute to the properties of each substance an existence distinct from its own. What matters it, then, whether we make spirits or fluids of these personified abstractions? Their origin is always identical. It constantly springs from that inquisitiveness into the hidden nature of things, which marks, in every race, the infancy of the human mind, and which first inspired the conception of gods; these gods were subsequently transformed into spirits and entities, and have finally been transformed into imaginary fluids.

Agreeably to the law of development, Physics had to pass through this transitional stage of metaphysics. Astronomy did the same. The astronomical metaphysical suppositions of Descartes, which were as ably supported as similar suppositions in Physics have been, gave way when the true nature of positive Astronomy was established by the discoveries of Newton. In like manner metaphysical notions have been driven from the more advanced parts of Physics. No man of note has, since the days of Galileo, propounded an hypothesis to explain the fall of bodies. But the less advanced parts of Physics, such as Light and Electricity, still suffer from this metaphysical influence. They do so from the same

causes which affected the others, and will, like them, be gradually emancipated.

Comte next occupies himself with the division of Physics into its principal branches. This division is, of course, based on the degree of *generality* of corresponding phenomena,—on the extent of their complication, their relative states of speculative perfection—and also their mutual dependence. Accordingly, the science of the phenomena of weight (*Barology* as he calls it,) ranks as the first branch by universal consent; and, on the other hand, the science of *Electrical phenomena* ranks last. The former is most allied to Astronomy; the latter forms a natural transition to Chemistry. They are at the two extremes of Physics, not only as respects generality and the other qualities just mentioned, but also in regard to their present states of positivity. Between these two extreme terms we have, first, Thermology, next Acoustics, and then Optics.

Having thus indicated the main points in his general considerations on Physics, I have passed over that portion of the ground which, from its abstract nature, will have had less interest to minds not specially versed in these subjects, than those which are to follow.

SECTION XI.

GENERAL CONSIDERATIONS ON CHEMISTRY.

With Chemistry we enter upon a science where the complexity of phenomena is greatly augmented, and where the nature of the phenomena is so sharply defined as to seem the result of essentially *different* forces, although, profoundly considered, there is no further difference than what arises from the *variety of direction* of the forces.

Physics treat of Masses acting at sensible distances; Chemistry treats of Molecules acting at insensible distances.. The Telescope and the Microscope are not more obviously separated, not more identical. Indeed that conception of the German philosopher, which elevates the chemical atom, by a sort of microscopic exaggeration, into the analogue of a planet, has deep meaning in it. He compares the *atoms* to the heavenly bodies, which are in truth but atoms in infinite space. Innumerable suns, with their planets and satellites, move at definite distances from each other, as the atoms of terrestrial masses do. The Methods in which these masses move, Science attempts to ascertain; but in Astronomy we speak of Motion, in Chemistry of Combination: both are Methods of the unknown unknowable Force, the variety of whose directions constitutes the variety of all phenomena.

I am only hinting here at a conception which hereafter will find its application; and hint it that the reader may follow out this long chain of scientific evolution with some sense of continuity, and some sense of the grand unity of Nature. Having done so, let us open Comte's

third volume, the first half of which is devoted to Chemistry.

He commences by remarking how the science of Chemistry is less advanced in its progress and more wanting in positivism than the other parts of inorganic physics. This is owing to its greater complexity, and to the fact that when the phenomena are intense in action they bear a striking resemblance to those of life, to which it is the very spirit of the Theological and Metaphysical philosophies to assimilate all phenomena. Chemistry labours also under this disadvantage, that a knowledge of its most important phenomena is only obtained by artificial means; whereas those chemical phenomena spontaneously presented to observation, such as fermentation, are the most complicated, and the last to be analyzed.

And, first, as to its definition. The general character of its phenomena distinguishes Chemistry very distinctly from Physics and Physiology, between which it stands. A comparison of the three makes the real nature of this science very apparent. The ensemble of the three sciences can be conceived as having for its object the study of the molecular activity of matter in all the different modes of which it is susceptible. Now, under this point of view, each of them corresponds to one of the three principal and successive degrees of activity, which are distinguished from each other by the broadest and most natural differences. In chemical action we have evidently something more than simple *physical* action, and something less than *vital* action, notwithstanding the vague analogies that may be drawn between these three orders of phenomena on purely hypothetical considerations. The only molecular perturbations which physical activity, properly so called, can produce in bodies, are modifications of the arrangement of the particles; and those modifications which are generally of no great extent are most frequently

of a temporary nature; in no case is the substance altered.

Chemical activity, on the contrary, always produces an essential and permanent change in the very composition of the particles, over and above the alterations in structure and state of aggregation: the substances originally present are not now to be recognized, so much has the ensemble of their properties been altered. Finally, physiological phenomena manifest material activity in a still greater degree of energy; for as soon as a chemical combination is effected the bodies become completely inert; whereas the vital state is characterized, not only by the physical and chemical phenomena which it constantly produces, but also by a double movement, more or less rapid, but always necessarily continuous, of composition and decomposition, capable of sustaining within certain limits of variation, and for a period more or less considerable, the organization of the body, by entirely renewing its substance. We thus conceive the fundamental gradation of these three essential modes of molecular activity, which true philosophy can never permit of being confounded together.

There are also two secondary considerations to be noticed respecting chemical phenomena.

First—Every substance is susceptible of chemical action, and this is why chemical phenomena have been properly classed among *general* phenomena. They are unlike physiological phenomena, these being peculiar to certain organized substances. But still, in each case of chemical phenomena a *specific* difference is found. Physical properties, on the other hand, show only differences in degree.

Second—In order to produce chemical phenomena it is requisite that the antagonistic particles be brought into immediate contact. When the structure of the substance does not spontaneously permit this, it must be artificially attained by liquefaction.

The foregoing considerations may be summed up by defining Chemistry as having for its general object, *the study of the laws of those phenomena of composition and decomposition, which result from the mutual molecular and specific action of different substances, natural or artificial.*

There is reason to fear, from the extreme imperfection of this science, that it will not, for a long time, admit of a more exact and more precise definition, capable of characterizing plainly what are in general the indispensable data, and the final unknown terms, of every chemical problem. But the idea of *science* is always combined with that of *prevision* in true philosophy, and the final aim of Chemistry ought, therefore, to be thus conceived :—*Given, the chemical properties of certain substances, simple or compound, placed in chemical relation, under well-defined circumstances, to determine exactly in what their action will consist, and what will be the principal properties of the new products.*

We easily conceive that if such solutions were actually obtained, the three great and fundamental applications of chemical science—to the study of vital phenomena, to the natural history of the terrestrial globe, and to industrial operations—would be thereby rationally organized, instead of being, as at present, the almost accidental and irregular result of the spontaneous development of science : seeing that in every one of these three general cases the question immediately falls within our abstract formula, the data of which are directly furnished by the particular circumstances of each application.

In examining more profoundly this rational definition of chemical science, and carrying out the principle of it another step, we shall find it susceptible of an important transformation ; for all the fundamental data of Chemistry could thus be reduced to the knowledge of the essential properties of simple substances solely, which would lead to that of the different immediate or

primary combinations, and thence to the most complex and most remote. We should then have to make each simple substance the direct object of experimental study by itself. It may be that there is a certain general and necessary harmony between the chemical and physical properties of each chemical substance; but we cannot go the length of saying that this harmony would ever dispense with a distinct and independent chemical examination of each of these substances. But if once our knowledge of the chemical qualities of each simple substance were completed, by observation and experiment, all the other chemical problems, notwithstanding their immense variety, would become susceptible of purely deductive solutions, by means of a small number of invariable laws, established by the true genius of Chemistry for the different classes of combinations.

Under this point of view compounds naturally present two general modes of classification, both of which necessarily require marked notice.

First, the simplicity, or the greater or less degree of composition of the primary combinations.

Second, the number of the combined elements.

Now, observation has shown that the higher the order of composition of any substances, the more difficult does chemical action between them become: the majority of compound atoms belong to the two first orders, and beyond the third their combination seems almost impossible; while, under the second point of view, compounds very rapidly lose their stability, in proportion as the number of elements is increased. Most frequently there is only a simple dualism, and scarcely any body is more than a quaternary. Hence the number of general chemical classes to which this two-fold and necessary distinction can give room can never be much extended. To each of them there would correspond a fundamental law of combination, which, when applied to any case in

hand, would deductively make known the result from the elementary data. It is to our own radical feebleness, and partly to the vicious direction of our intelligence, much more than to the peculiar nature of the subject, that we must specially attribute the cause of our being yet so very far from such a method of philosophizing. However difficult it may appear at present, we ought not to forget that we find it realized to a certain extent, in a very important though secondary category of chemical researches—the study of proportions. By the aid of a chemical co-efficient, evalued empirically for each simple substance, we are able, in numerous cases, with sufficient exactness, to determine deductively, from a small number of general laws, the proportion according to which the compounds previously known unite in each new product. Why should not all the other branches of chemical study allow in the end of a perfect analogy?

We may sum up these observations by defining Chemistry as having this for its ultimate object:—*Given, the properties of all simple substances, to find those of all the compounds which they can form.*

Chemistry, when compared with the preceding sciences, affords a strong verification of the law that the complexity of the sciences, and their means of exploration, increase together.

It is here that the first and the most general of the three essential modes of investigation, which we have distinguished in Natural Philosophy, begins to receive its integral development; until arrived at this science, *observation* is in fact always more or less partial. In Astronomy, it is necessarily limited to the exclusive employment of a single sense; in Physics, hearing, and particularly touch, come to the aid of sight; but taste and smell remain essentially inactive. In Chemistry, on the contrary, all the senses simultaneously concur in the analysis of its phenomena. We can

form a correct idea of the increase of power which results from this convergence, by trying to picture what would become of Chemistry if it were necessary to renounce the use of smell and taste—these very often furnishing us with the only characteristics by which we could recognize and distinguish the different effects produced. But what the philosophical mind ought especially to observe on this subject is, that in this correspondence there is nothing accidental, nor even empirical. Because the true physiological theory of sensation clearly shows that the apparatus of taste and smell, unlike those of the other senses, acts in an eminently chemical way, and that, consequently, the nature of those two senses specially adapts them for perceiving the phenomena of composition and decomposition.*

With regard to *experiment*, Comte repeats that the part it plays in Chemistry is altogether overrated, great though its efficacy undoubtedly is, and greater though it will be when the science is cultivated more philosophically; for chemical effects usually depend on too great a concurrence of different influences to make it easy to throw light on their production by true experiments. We should have the difficult task of instituting two parallel cases, exactly identical in all their characteristic circumstances, save in that one of which we desire to find the value; this being the fundamental condition of all unexceptionable experiment. The nature of philosophical investigations presents a complete obstacle to the purely experimental method, the use of which is almost always illusory there; and it is in Chemistry, owing to the complication of its phenomena, that we first meet with this same impediment, although to an infinitely less extent.

* In a passing note I venture to question Comte's assertion as regards this peculiarity of Taste and Smell; the phenomena of Vision are quite as much dependent on chemical action.

Finally, with regard to the third fundamental mode of rational exploration, *comparison*, properly so called, the least general of all; it is of importance to consider here, that if this process is essentially destined for physiological studies, its employment first begins to acquire a real efficacy in chemical researches. The essential condition of this precious method consists in the existence of a sufficiently extended series of analogous but distinct cases, where a phenomenon common to them all is more and more modified, both by simplifications and by a successive and almost continuous decrease in the degree of its manifestation. Evidently, physiological phenomena can alone give complete scope for the employment of this method. But the admitted existence of natural families in Chemistry makes it probable that, in the future progress of this infant science, a corresponding classification will yet be made, which will lead to the use of the comparative method in Chemistry, both being founded on the common considerations of uniformity in certain preponderating phenomena displayed in a long series of different bodies.

Chemical investigations enjoy the advantage of a verification by means of the double process of *analysis* and *synthesis*. Strictly speaking, the process of synthesis, though useful, may be dispensed with when the object of the experiment is to discover the simple *elements* of a given substance; whereas, when the experiment is made to find out what are the compounds which *immediately* form the given substance, we may in appearance obtain them, but have in reality got compounds produced by new combinations in the course of the process. In the latter case, therefore, synthesis is generally indispensable to ensure certainty. As the higher its order the more does the stability of a compound decrease, and conversely, the facility of recomposition increase, it follows that we can most easily apply the synthetical method where it is most needed.

SECTION XII.

POSITION AND METHOD OF CHEMISTRY.

We have still to occupy ourselves with the general considerations forming the prolegomena to Chemistry, and notably with its position in the hierarchy of the sciences, and its Method.

We may make this capital distinction between Physics and Chemistry:—In Physics (celestial and terrestrial) we study the laws of motion *communicated;* in Chemistry (inorganic and organic) the laws of motion *excited.* In purely physical phenomena we see a force communicated from one body to another; but in chemical phenomena we see a force combining with another force to excite a change in the phenomena of both, the result of which is unlike either.

I content myself with indicating this distinction, and turn to Comte for further light as to the position of Chemistry in the scientific hierarchy. The position he assigns to it seems to him a good illustration of the fact that his classification does not rest on arbitrary assumptions, but is in truth the faithful *resumé* of the points of harmony inherent in the sciences, and manifested naturally by their common development. No one, indeed, of the positions in the encyclopedical scale seems so naturally and so appropriately occupied as that of Chemistry between Physics and Physiology. Who could now fail to see that, in several essential parts, and above all in the important series of electro-chemical phenomena, Chemistry is in immediate contact with the ensemble of Physics, of which, in appearance, it constitutes a simple prolongation; and, again, that at its

other extremity it is in some sort connected, by the no less fundamental study of organic combinations, with general Physiology, of which it establishes, so to speak, the primary foundations? These relations are so very close that, in more than one particular case, Chemists who had not mastered the true philosophy of the sciences could not venture to decide whether the subject really fell within their province, or whether it belonged to Physics or Physiology.

Chemical are more complex than physical phenomena, and less general. We have physical without chemical effects, but no chemical effects unaccompanied with co-existent physical. Hence, too, Chemistry is indirectly subordinated to Astronomy, and even to Mathematics. As far as respects doctrine, the connection is indeed small. Chemical questions cannot be treated among mathematical doctrines;* and in *abstract* Chemistry there is little reference to Astronomy. In *concrete* Chemistry, *i. e.* in the application of chemical knowledge to the natural history of the globe, the connection between Astronomy and Chemistry is much more apparent. As respects Method, Mathematics and Astronomy have had a great influence on the cultivation of Chemistry. From the study of mathematical phenomena have been obtained habits of rationality, precision, and consistency. Although mathematics are less needful to the chemist than to the natural philosopher, the evil effects of the want of those habits, owing to a defective mathematical education, may be seen in most chemical speculations. Astronomy being the great type of scientific perfection, its influence is the more needed in Chemistry, because the phenomena are increased in complexity. Astronomy is calculated, much more than

* This was true when Comte wrote, in 1838; but now chemical questions are beginning to be susceptible of purely mathematical treatment.

Physics, to show Chemists the radical inanity of all metaphysical explanations, and to make manifest the true characteristics of their science. Comte also shows here, but more fully in his lecture on Physiology, how that science must be based upon and follow in the wake of Chemistry. He next proceeds to estimate the general perfection of chemical science, as respects method and doctrine.

As to Method, physical philosophy has approximated much nearer than chemical philosophy to the complete state of positivity. If the first still presents, with respect to the theory of hypotheses, a *quasi*-metaphysical character, there is no exaggeration in saying that the second continues in some respects essentially metaphysical in spirit, by reason of its more difficult and more tardy development. The doctrine of *affinities*, although now rapidly losing its hold, is even more ontological than that of the *fluids* and imaginary *ethers*. If the electrical fluid and the luminous ether are really nothing but materialized entities; are these affinities anything else than pure entities, as vague and indetermined as those which flourished in the scholastic philosophy of the middle ages? The pretended solutions which we have been in the habit of deducing from them, evidently possess the essential characteristic of metaphysical explanations—*the simple and naïve reproduction, in abstract terms, of the very statement of the phenomenon.* The accelerated development of chemical observations during the last fifty years, which will doubtless soon discredit for ever this false philosophy, has hitherto only modified it in such a way as to show its radical nullity with irresistible evidence. When affinities were regarded as absolute and invariable, their employment in the explanation of phenomena, although of necessity always illusory, had at least a more imposing appearance. But since facts have compelled us to conceive affinities as, on the contrary, eminently *variable* and dependent upon

a multitude of different circumstances, their use could no longer be continued, without speedily becoming, by this single change, more plainly futile and almost childish. Thus, for example, it was known for a long time that at a certain temperature iron decomposed water or protoxide of hydrogen; and yet it was afterwards discovered that, under the mere influence of a higher temperature, hydrogen in its turn decomposed oxide of iron. What, then, can signify the order of affinity which we believed we had established between iron and hydrogen towards oxygen?

The state of education at the time explains how men of genius like Berthollet could entertain such notions as that of *elective* affinities. It is to those metaphysical habits that we owe the doctrine of *predisposing* affinity, employed even by the great Berzelius. For example, when sulphuric acid determines the decomposition of water by iron, at ordinary temperatures, so as to disengage hydrogen, the metaphysical explanation of the process is—That sulphuric acid has an affinity for oxide of iron, which *tends* to form itself. Observe, the oxide of iron does not as yet exist; it exists only *after* the decomposition has taken place; so that on this doctrine of affinity we have the sympathetic action of one substance upon another substance not yet in existence, but called into existence by this sympathetic action! Even Liebig, who repudiates the notion of affinity as expressive of anything like *relationship*, has not emancipated himself sufficiently from the metaphysical condition to give up the notion of an inherent *tendency*.

As another example of metaphysical Chemistry, consider the favourite notion of a *catalytic force*. The following passage, from Gregory's admirable *Handbook of Organic Chemistry*, expresses my views with authority:—

"The view adopted by Berzelius, according to which fermentation, and all the other phenomena of chemical

change produced by contact, are the results of a peculiar unknown force, the catalytic force, coming into action when certain bodies are placed in contact, appears unphilosophical, as in the first place, assuming the existence of a new force where known forces would suffice to explain the facts; and, secondly, as furnishing no real explanation, but merely acknowledging, indirectly, our inability to offer any such explanation. When we ascribe an effect to catalysis, we are only saying, in other words, that we cannot account for it; catalysis is thus merely a convenient term for all that we do not understand. And to the use of the word in this sense, namely, as a name for the agent which produces certain effects, the agent itself being unknown, there would be no objection, were it not that catalysis has been employed to account for phenomena not only different from each other, but actually of an opposite kind. For example, platinum, in causing *the combination* of oxygen and hydrogen, is said to act catalytically, and the action of oxide of manganese, or oxide of silver, in decomposing peroxide of hydrogen, that is, in causing *the separation* of oxygen and hydrogen, is also called catalytic. This example proves how loosely the word has been employed, and how vague are the views which have led to its introduction."

In accordance with the position of chemistry in a scientific hierarchy, the general plan of rational education for a chemist requires a preliminary study of mathematical philosophy, next of astronomical philosophy, and last of physics. We should remember, when speculating philosophically on this subject, that this doctrine of affinities is only an attempt (necessarily a vain one) to conceive the *hidden nature* of chemical phenomena, which is as radically inaccessible as the analogous essences men sought in former times to discover, by similar processes, in the case of more simple phenomena. And how can the chemist aid in

ridding his science of these metaphysical ideas, without first mastering the more simple and now more positive sciences? How, if half-metaphysical as regards them, can he be positive in chemistry? Must not the individual, like the species, in its gradual development, extract positive conceptions from the simpler sciences first?

In respect of doctrine, chemistry is also inferior to physics. Chemical effects are still essentially incoherent, or at least feebly co-ordinated by a small number of partial and insufficient relations, in place of those laws, as certain as they are extensive and uniform, which are justly the glory of physics. As to *prevision*, the true measure of the perfection of each natural science, it is too evident that if it is already much more limited, more uncertain, and less precise in physics than in astronomy, the case is still worse with Chemistry. Most frequently, the issue of any chemical action can only be known by taking express account of the circumstances of the moment, and, as it were, at the time the action is ended.

Let us now glance at the most distinguished of the philosophical properties of Chemistry, with reference to their direct bearing upon the fundamental education of humanity.

On this point, and in the first place, as to Method, Comte refers to the high philosophical utility of the arts of experiment and observation as practised in Chemistry. But there also exists in the system of positive method a very important part, too little appreciated as yet, and which Chemistry had the special function of bringing to the highest degree of perfection. Comte does not here speak of the theory of classifications (sufficiently ill understood by chemists), but of the general art of rational Nomenclatures, which is altogether independent of it, and of which Chemistry, by the very nature of its subject, must present more perfect models than any other fundamental science.

Attempts have often been made, especially since the reform of chemical language, and they are still daily made, to form a systematic nomenclature in Anatomy, in Pathology, and especially in Zoology. But whatever may be the real utility of these praiseworthy efforts, they have not, and never could have been, followed by a success like that of the illustrious founders of chemical nomenclature, even if they were better conceived and more rationally directed than they have hitherto been; for the nature of the phenomena peremptorily forbids it. It is not accidentally that chemical nomenclature is so perfect compared with all the others. In proportion as the phenomena increase in complexity, the objects are characterized by points of comparison at once more varied and less circumscribed. It consequently becomes more and more difficult to subject them in a manner sufficiently expressive to a uniform system of denominations, rational and at the same time abridged, and to have this system adapted really to facilitate the habitual combination of ideas. Were it that the organs and tissues of living bodies only differed among themselves in one single and capital point of view,—that diseases were sufficiently defined by their seat,—that zoological genera, or at least families, could be always formed on one principle completely homogeneous,—then we might conceive that the sciences would immediately allow of systematic nomenclatures as rational and as efficacious as that of chemistry. But, in reality, the profound diversity of the numerous aspects under which they present themselves, and which are almost never susceptible of being co-ordinated uniquely under one of them, evidently renders our arriving at such perfection both very difficult and little advantageous.

Among the sciences in which the immense multitude of subjects spontaneously give rise, at their formation, to special nomenclatures, Chemistry is the only one where, from its nature, the phenomena are sufficiently simple

and uniform, and at the same time sufficiently determined, to permit of a nomenclature at once clear, rapid, and complete, and thereby contributing to the general progress of the science. The direct and ruling idea in chemistry is incontestably that of *composition*; and the peculiar object of the science is to make all chemical questions resolve themselves into one of composition. Hence, since the systematic name of each body would make its composition directly known to us, it can easily give us a general but correct notion of the ensemble of its chemical history; and afterwards serve to us as a faithful and concise summary of that ensemble; and from the very nature of the science, the nearer it advances towards its final destination, the more will this double property of its nomenclature be inevitably developed.

Thus Chemistry must be considered as eminently suited to develope, in the most special manner, one of those fundamental means of obtaining and using knowledge (so few in number) which together constitute the general power of the human mind. Comte has endeavoured to show very clearly the principal causes of the evident superiority which results from the very nature of chemical science. But although he required to do so, it is incontestable that the formation of systems of rational nomenclatures in the more complex sciences must possess a real and engrossing interest, notwithstanding that they are necessarily more difficult to establish there, and less efficacious in their use. He desires to make clear the indispensable necessity of every class whatever of positive philosophers having recourse exclusively to chemistry for extracting the true principles and general spirit of the art of scientific nomenclatures. This is just in accordance with that fundamental rule, already carried out in so many other respects, in the *Cours de Philosophie Positive*—viz. what each logical artifice ought to

be directly studied in that part of natural philosophy which offers the most spontaneous and most complete development of it, with the ultimate object of our being able to apply it, with proper modifications, to make more perfect the other sciences.

The eminent philosophical properties of Chemistry are still more remarkable in respect of Doctrine than of Method. Its development has contributed much to the emancipation of human reason from theological and metaphysical doctrines. If Chemistry, from increase of complexity, is defective in one of the two attributes which tend to that emancipation—namely, *prevision of phenomena*, it is—as a necessary and compensating consequence of the same fact—strikingly provided with the other—namely, *the power of modifying them at our pleasure*. Neither can co-exist with the idea of a government by providential volitions.

Besides, Chemistry has aided in emancipating the human mind, by rectifying our primitive notions respecting the general economy of terrestrial nature. Although, since Aristotle, philosophers entertained the notion that the same elementary substances essentially reproduced themselves in all the great operations of nature, notwithstanding their apparent independence; nevertheless, it necessarily resulted from the utter impossibility of realizing this vague and metaphysical anticipation of the truth, that the universal dominion of the theological dogma of absolute *destruction* and *creation* kept its hold until the great epoch of that admirable development of chemical genius which forms the principal scientific characteristic of the last quarter of the eighteenth century. In fact, so long as we could take no account of gases, either as the elements or the products of chemical action, a great number of remarkable phenomena inevitably encouraged the belief in the annihilation or the actual production of matter in the general system of nature. Certain discoveries

were requisite to establish beyond cavil the fundamental principle of the necessarily indefinite perpetuity of all matter; such, especially, were the decomposition of air and water, and afterwards the elementary analysis of vegetable and animal substances, and perhaps, too, at a later period, as the complement of those, the analysis of alkalies properly so called, and of earths. The tendency of those discoveries was irrevocably to substitute in all minds the positive notions of *decomposition* and *recomposition*, for the theological notions of *destruction* and of *creation*. A new light, also, was thereby thrown on vital phenomena. It was perceived that organic and inorganic matter were not radically different; and that vital transformations are, like all others, subordinated to chemical phenomena.

Comte concludes the chapter with some remarks respecting the divisions of chemistry. The science, he says, is still too much in its infancy, and too imperfect, to offer, of itself, a proper division. The *homogeneity* of its phenomena, so exceptional when contrasted with other sciences, makes a natural division of it little marked. It is clear, however, that in the meantime the division of chemistry into inorganic and organic, must be disregarded, as being irrational. Combinations cannot be classified in abstract chemistry according to their origin, as they may be in natural history. The two classes referred to are always mutually encroaching on each other. In reality, what is called organic chemistry is half chemical, half physiological.

Any rational division must be founded on the principle involved in the true definition of the science—that of composition and decomposition. Hence, in here applying the rule of always following the gradual complication of the phenomena, we see that, in dividing chemistry into its principal branches, we can be guided by only these two considerations.

1st. The increase of the number of the constituent

compounds (whether mediate or immediate), according as the combinations formed by them are either binary or ternary, &c.

2nd. The degree of composition, lower or higher, of the immediate compounds, each of which, to take for example the case of a repeated dualism, can be decomposed a greater or less number of times into two others.

It may be questioned which of these two points of view ought to preponderate. According to Comte, the chief consideration belongs to the degree of composition, as it is a matter of more importance in the science than the multiplicity of the constituent compounds.

Having closed the general considerations, he proceeds in subsequent lectures to treat of Inorganic Chemistry in general, and of the doctrine of Definite Proportions, and the Electro-chemical theory in particular. In these lectures, the student will, of course, note many details which in so rapidly advancing a science as Chemistry have assumed a new aspect since 1838, when the lectures were published; but the *philosophy* of Chemistry he will there find set forth in large outlines.

SECTION XIII.

ORGANIC CHEMISTRY.

It may be taken as evidence of the erroneous views current among scientific men on the true nature of science as respects Classification, that a distinct body of doctrine should claim for itself a distinct existence in the shape of a "Science of Organic Chemistry." Against this supposed science, Comte energetically protests as a source of inevitable confusion, and as a consequence of the absence of that Philosophy of Science which he has endeavoured to elaborate.

Open Dr. Gregory's admirable *Handbook of Organic Chemistry*—the latest published—and read this definition: "Organic Chemistry is so called because it treats of the substances which form the structure of organized beings and of their products, whether animal or vegetable." Now, although it is not possible, I believe, to draw a line of demarcation between the inorganic and organic worlds,—although the differences we observe are not *essential*, but *phenomenal*,—nevertheless positive philosophers, who only study phenomena, recognise a marked difference between the phenomena of organized and those of inorganized substances,—a difference which necessitates a corresponding difference in Classification; and as the phenomena of organized matter are regulated by special laws not applicable to inorganized matter, we ought to isolate them from the phenomena of inorganized matter. Comte, therefore, properly objects to physiological phenomena being treated as simple chemical phenomena;

he objects to the Chemist undertaking to solve problems which require the co-operation of the Physiologist; he objects to a science which, while it has physiology for its subject matter, attempts to dispense with physiological Method. The very phrase, Chemistry of *organized* bodies, implies the presence of an element not within the competence of Chemistry, except upon a vicious extension of the term. Chemistry does not concern itself with the phenomena of Life; yet those phenomena are necessary to *organized* bodies!

In protesting against making Organic Chemistry a separate science, he must not be understood to underrate the importance of inquiries into the chemistry of organized bodies. His meaning is, that you might as well constitute a science of Animal Mechanics from the specification of all the mechanical phenomena observable in animals, as a science of Organic Chemistry from a specification of the chemical phenomena noticeable in organic bodies.

Physiology is subordinate to Chemistry; the greater complexity of its phenomena embraces chemical laws, and some other laws peculiar to itself. That the physiologist could not create his science without the aid of Chemistry, lies in the very nature of Physiology; but the chemist can and does create Chemistry without the aid of the physiologist. Therefore positive philosophy insists upon a division of this said Organic Chemistry into two different parts; 1st. That which relates to Chemistry, properly so called. 2nd. That which relates to Physiology. Few minds familiar with the importance of Method will fail to appreciate the necessity of this division.

The general principle upon which this division must be founded, Comte says, resides "in the essential separation of the condition of Death from that of Life, or, what comes to nearly the same thing, the stability and instability of the proposed combinations subject to the influence of ordinary agents. Among the various com-

pounds indistinctly united under the term organic, some owe their existence to the vital movement, are subject to continual variations, and almost always constitute simple union: these cannot belong to Chemistry, but to Biology, static or dynamic, according as we study them in their fixed state, or in the vital succession of their regular changes: blood, lymph, fat, &c., are of this class. The others, on the contrary, forming the proximate principles of these, are substances essentially dead, susceptible of remarkable permanence, and presenting all the characters of true combinations, independent of life: these, the organic acids, alcohol, albumen, urea, &c., belong to the domain of Chemistry, for they are the same as inorganic substances."

How, then, is the Chemist to distinguish between what belongs to his domain and what to the domain of Biology? By a very simple rule. He has only to examine *whether the proposed problem can be solved by the application of chemical principles alone, without the aid of any consideration of physiological action whatever.* As soon as any of the phenomena of Life manifest themselves, he is warned of the presence of more complex agencies than are "dreamt of in his philosophy."

It is well known that although we can create certain organic compounds, we can only do so by the degradation of some previously-existing organic substance. It is in vain that we analyze organic matters and ascertain their elements; we cannot put those elements together again, as we can with inorganic substances. *There* lies a mystery of synthesis to be touched on hereafter.

And this leads me to some considerations which may not be out of place, as an introduction to the next section.

Is there, except as a scientific artifice, any distinction between Inorganic and Organic bodies? No. The same elements are common to both; the differences in the phenomena are owing to differences in the *arrange-*

ment of these elements; just as starch, wood, and sugar are different in their properties, though composed of the same elements.

Whether we suppose the unknown Forces which manifest themselves in phenomena to be *many*, or *one*, *taking many directions*—whether we suppose the so-called elementary atoms to be distinct elements, or one element, the conclusion is not affected that, Between inorganic and organic bodies one principal distinction lies in the latter being combinations of more complex orders. Thus, a particle of salt is composed of a group of two atoms, while a particle of olive oil is composed of several hundreds of atoms. From the dawn of organic life upwards, we perceive an ascending complexity, owing, primarily, I believe, to the *greater multiples of the elementary equivalents*. Thus, if a particle of salt contains only two atoms, these two atoms only attract each other in *one* direction; but in a particle of sugar, which consists of thirty-six atoms, the attraction is acting in thirty-six different directions. "Without adding," says Liebig, "or withdrawing any element, we may conceive the thirty-six simple atoms, of which the atom of sugar consists, to be arranged in a thousand different ways; with every alteration in the position of any single atom of the thirty-six, the compound atom ceases to be an atom of sugar, since the properties belonging to it change with every alteration in the arrangement of the constituent atoms."—(*Letters on Chemistry.*)

The four elements, named *organogens*, oxygen, hydrogen, carbon, and nitrogen, are infinite in their modes of combination. Lead and oxygen combine in two proportions only, viz., the protoxide Pb O, and the peroxide Pb O^2, and these unite to form a third combination, red lead. But the combinations of the organogens are innumerable, and differ, not only in relative but in absolute quantities (Mulder: *Physiologische Chemie.*)

And it is from the infinite variety of these combinations—these directions of force, that the variety of organic phenomena proceed.

To make intelligible by an illustration this effect of different arrangement: When iron is in mass it has but a slight tendency to become oxidized; but the same mass of iron, if *minutely divided*, cannot be brought into contact even with atmospheric air at a low temperature, without becoming red hot, and at the same time becoming converted into an oxide. Cobalt, nickel, and uranium possess the same qualities (Mulder). What is the explanation of this curious fact—which, by the way, is at the service of homœopathists as an argument for triturated medicines?—not that the particles of iron *acquire a new force* by division; but that these molecules, when accumulated into a mass, are prevented from acting in *that* direction, and their force is what we call "latent."

We come, then, to the conclusion that, between the inorganic and the organic there is mainly a difference of combination, *an increasing complexity in the lines of direction of force.* This is the foundation-stone of the dynamical theory. Once suppose a new force *created*, and the mechanical theory will support the pretensions of metaphysics; *development* will give place to incessant *creation*, and the metaphysical entities named Vital Principles will reign supreme. For, observe, the marked *phenomenal* difference between organized and inorganized matter naturally strikes men as arising from *essential* differences. "There was a time when men could not account for the origin of the lime of the bones, the phosphoric acid in them and in the brain, the iron in the blood, and the alkalies in plants; and we now find it inconceivable that this ignorance should have been regarded as a proof that the animal or vegetable organism *possessed the power of creating iron, phosphorus, lime, and potash, by virtue of its inherent vital forces*, out of food containing none of these substances.

This convenient explanation naturally put an end to the inquiry as to their real origin, and arrested true investigation." (Liebig.)

Unless we accept some such metaphysical explanation, how are we to understand—if inorganic and organic are essentially different—the ordinary processes of nutrition and growth? A plant takes from earth, air, and water certain gases, which it converts into cellular tissue, and thence into woody tissue, and so on—*i. e.*, *creates* organic matter from inorganic matter; plays the part of a God by virtue of its "inherent vital forces!" Whereas, on the dynamic theory, although the mystery of Life remains as inaccessible as ever, the Methods of Nature are at least conceived to be consistent and homogeneous.

Many prejudices will be shocked by this identification of the organic with the inorganic; but Truth is always consistent with itself, and on no other conception can the whole of the phenomena be made consistent. This denial of any *essential* distinction between the organic and inorganic is confirmed by Mulder, the greatest philosophic chemist of the day; and to the first ninety-five pages of his *Physiologische Chemie* I refer the reader.* Indeed, one of the most indisputable truths which the study of Nature elicits is the impossibility of drawing definite lines of demarcation. Every one knows how the animal and vegetable kingdoms are inextricably interlaced at their boundaries; and when men find the articulations of the *Gallionella ferruginea*—one of the Infusoria discovered by Ehrenberg—composed almost entirely of oxide of iron, they are puzzled where to draw the line between the mineral and the animal. Müller, indeed, insists upon an essential distinction between the molecular and vital action. "Chemical compounds," he says, "we know are regulated by the intrinsic proper-

* There is an English translation, edited by Prof. Johnstone, published by Messrs. Blackwood and Sons.

ties and the elective affinities of the substances uniting to form them; in organic bodies, on the contrary, the power which induces and maintains the combination of their elements *does not consist in the intrinsic properties of these elements*, but is something else, which not only *counteracts these affinities* but affects combinations in direct opposition to them, and conformably to the law of its own operation."

This is an abstract statement of the almost universal proposition, that the vital force overrules chemical action —that the body, for instance, resists decomposition while alive, but as soon as life has left it, chemical action resumes its wonted efficiency, and decomposes the substances formerly protected by vital force. This is almost universally believed to be the explanation of an obvious fact. That it is a purely *metaphysical* explanation I hope the reader sees at once. Vital force is one of the metaphysical entities. A more intimate acquaintance with chemical and physiological phenomena will, I am persuaded, prove the explanation to be wholly erroneous. As Liebig truly says, "So far from there being any foundation for the opinion that chemical force is subordinate to vital power, so as to become inoperative or imperceptible to us, the chemical effects of oxygen in the process of respiration, for example, are seen in full activity during every second of life." He might have multiplied the examples indefinitely. Whenever we think we see chemical force *inoperative* it is simply because the force is acting in *another direction*. The same phenomenon occurs in purely chemical combinations. For example, sulphur has an affinity for lead —*i. e.*, when the direction of its force is not counteracted by some other direction—when its path is not intersected by some other path, it will combine with lead. But if we fuse a mixture of iron and lead together with sulphur in a crucible, the iron separates from the lead and combines with the sulphur; and so long as there is

any particle of iron uncombined with sulphur, so long does the affinity of the sulphur for the lead remain inoperative. When all the iron is combined, *then* the sulphur which remains free combines with the lead. What is this but the analogue of that very process which prevents the decomposition of a living body by the action of atmospheric air, and permits the decomposition of the dead body? Or, again, when water poured into a red hot crucible is converted into *ice*, if there be liquid sulphuric acid present, are we to suppose chemical force inoperative because the ordinary effects of heat upon water are thus changed?

That a great difference exists between chemical phenomena and vital phenomona I have already admitted, and upon that difference rests the necessity for a separation of the sciences of Chemistry and Biology, and consequently the effacement of any distinct science of Organic Chemistry. But this difference is not essential. It does not arise from the presence of a *new* force, but from the complication of the phenomena owing to the *varieties in direction* of the one unknown force. It is a new evolution, not a new creation.

An egg is organic, but it is not living. That is to say, its component molecules are so arranged that the application of a determinate force (heat) will give a determinate direction to its molecules, which will result in the phenomena of life. The seeds which were found in Egyptian tombs, where they had lain for thousands of years, were not *alive;* they manifested none of the phenomena of life; they might have existed an eternity in that state; yet by placing them in proper conditions they germinated—lived. Now there are three explanations of this fact.

1st. The seed had a "vital principle" within it, capable of manifesting itself under suitable conditions.

2nd. The seed received life from heat, which is a "vital principle."

3rd. The seed was a peculiar arrangement of organic

molecules, which, when a determinate direction was given to its forces, manifested certain phenomena collectively named life.

The two first are pure metaphysical assumptions; the last is an abstract statement of what observation reveals.

"If," says Mulder, "we review the phenomena of life caused by a change of materials, we must go back to the original formation of organs—to the growth of an individual from a germ. We perceive no greater traces of the future Oak in the Acorn, than of the Chicken in the embryo of the Egg. Should we say that the Acorn is governed by an Oak-forming Force, the embryo by a Chicken-forming Force? Though it cannot be denied, that, in the embryo, the *rudiments* of the future organs of the Chicken are not to be found; yet we do find the materials from which the first rudiments of organs will be produced, ere we find rudiments of rudiments. The molecular forces, which are inseparable from matter, are present as well as the materials. If in these molecules there exists no capacity of becoming organs, (*i. e.*, if the *directions* are not determinately such as will produce organs,) and if in the germ of organs there exists no capacity of ultimately becoming organs, no Chicken at all is produced. This capacity, this predisposition (*i. e.*, this possible direction) must be present in the molecules, otherwise the heat necessary for hatching would be insufficient to produce germs of organs, in the first place, and organs afterwards, (*i. e.*, the *direction* being different, the result would be different.) This is the only reason why the embryo of the Egg will not produce an Oak, nor an Acorn a Chicken."

To this it may be answered that the cause of the predisposition to form organs is the latent "vital principle," or Chicken-forming force. But I ask—Why assume the presence of this mysterious entity? How, if the egg be addled, and no organs are produced, where is the vital principle then?

What *evidence* have you for the existence of any such

mysterious entity as the so-called "vital principle?" The fact that chickens and oaks *do* necessarily result from certain combinations of matter under certain conditions? But there is in this process nothing more than we see in the analogues of the inorganic world; in crystals for example: a solution is before me, having none of the appearances or properties of crystals, yet by a touch with a feather, the whole mass becomes crystallized, and into crystals as definite in form and properties as the Chicken or the Oak. Is there a Crystal-forming Force—a Crystal-Principle latent in that solution? Again: evaporate a solution of sulphate of soda in water, and you get prisms. Are we to suppose that the sulphate of soda exists as minute prisms in the solution, or that a Prism-Principle is latent therein?

BOMBAY
BRANCH
OF THE
NATIO

SECTION XIV.

THE PASSAGE FROM THE INORGANIC TO THE ORGANIC.

THE mysterious *process* by which Nature passes from the Inorganic to the Organic has in all times ardently occupied the speculation of philosophers; and in laying before the reader a brief outline of a new theory on this subject, I wish, while bespeaking his attention, to let him distinctly understand that this is no attempt to penetrate inaccessible mysteries, or to transcend the limits of positive philosophy. Speculators on this subject have been haunted by the old phantom of The Absolute; they have hungered after forbidden knowledge, and instead of resigning themselves to the position of "spectators and interpreters of Nature," they have aimed at being Frankensteins.

In a work on Positive Philosophy no such ambition can find a place; and therefore it is that I preface this section with a warning. The *stages of evolution* are all which will here be spoken of; not the actual *causes*. As in Embryology we record certain processes, certain stages of evolution, certain necessary conditions and consequences, without pretending to ascertain *how* the embryo becomes an embryo,—*why* certain materials are assimilated,—*why* certain forms invariably result with invariable sequence; so in this earlier Embryology —if it may be thus named—I do not pretend to record more than the indispensable conditions and constant phenomena of the passage from the simple to the complex,—the Inorganic to the Organic.

The dynamic differences between the Organic and the Inorganic are obvious enough, and have often been

enumerated; but all dynamic differences result from static differences—all *function* must involve *structure*, and the static characters of organic bodies have never been properly enumerated.

In what does the Organic statically differ from the Inorganic? Metaphysicians solve the problem in a facile way; facile, but futile! They declare that Organic matter differs from Inorganic in being endowed with Vital Force or Vital Principle. This is like Molière's physician explaining that opium caused sleep because it had a soporific virtue! It is saying, "vitality is due to a vital principle!" An explanation entirely satisfactory to the metaphysical mind; less so to the positive mind.

Enough of metaphysicians! Let us turn to the men of Science, and ascertain what answer they can give. Many have been satisfied with the explanation suggested by Berzelius, Fourcroy, De Blainville, Müller, and others, —viz. that Inorganic bodies are formed by *binary* combinations, Organic by *ternary* or *quaternary* combinations.

"In mineral substances," says Müller, "the elements are always combined in a binary manner; thus two elementary substances unite together, and this binary compound unites again with another simple substance, or with another binary compound. For example, carbonate of ammonia is constituted of carbon, oxygen, hydrogen, and nitrogen, combined as follows:—

Carbon Oxygen	unite to form	carbonic acid	which again unite to form carbonate of ammonia.
Hydrogen Nitrogen	" "	ammonia	

In minerals the elementary substances are never observed to combine three or four together, so as to form a compound in which each element is equally united with all the others. This, however, is universally the case in organic bodies. Oxygen, hydrogen, carbon, and nitrogen, the same elements which by binary combi-

nation formed inorganic substances, unite together, each with all the others, and form the peculiar proximate principles of organic beings. These compounds are termed ternary, or quaternary, according to the number of elements composing them. Vegetable mucus, starch, and adipose matter, are ternary compounds of oxygen, carbon, and hydrogen: gum, albumen, fibrin, animal mucus, and resin, are quaternary compounds, their fourth ingredient being nitrogen. A doubt has recently been thrown upon this theory of the composition of organic substances, especially with respect to some particular products, such as alcohol; but there is still great probability in its favour, and more particularly in reference to the higher organic compounds, such as albumen, fibrin, &c."*

I have quoted the whole passage from Müller because it succinctly expresses a very general conception; but the conception is, as Mulder energetically says, *durchaus unchemisch*—"altogether unchemical." The discovery of *radicals* upsets the whole theory. Ether, for example, does not consist of C^4H^5O but of $C^4H^5 + O$,—that is to say, the four equivalents of Carbon, the five of Hydrogen, and the one of Oxygen, do not form a ternary compound, each combining with the other two; but the Carbon and the Hydrogen combine together, forming a compound radical named Ethyl, and this afterwards combines with oxygen and forms Ether. The oxygen here introduced may be separated from the group, and sulphur, bromine, or chlorine substituted. Thus, whether we admit the theory of the existence of compound radicals, as most chemists hold it, or whether we side with those who question it,† the facts upon which the theory is built overthrow the old hypothesis of ternary combinations. Indeed, Chemical Philosophy is daily advancing

* Müller's Physiology, translated by Baly.

† See, for instance, Robin and Verdeil: "*Traité de Chimie Anatomique.*"

more and more to a recognition of the necessary *dualism* of all chemical combinations.

This hypothesis of binary and ternary compounds adumbrates one portion of the truth,—it points out that the combinations necessary for organic bodies are more *complex* than those for inorganic bodies; or, as Mulder puts it, "if any distinction is allowable we must place it in the fact that *compound radicals* exist in the former, and *simple radicals* in the latter." The point on which chemists are agreed is one mentioned in the previous section (p. 135)—viz. that organic substances differ from the inorganic in possessing *higher multiples of equivalents*, or in other words that the organic molecule is a greater multiple of forces than the inorganic molecule.

The first stage in our inquiry is attained. We arrive at one capital distinction between Organic and Inorganic substances, and can set forth this primary static Law:—

LAW I. *The elements which compose Organic substances are the same as those which compose Inorganic substances; but in the Organic they occur as higher multiples.*

In an exhaustive view all organic substances are to be considered—

1st. As to their Elements;

2nd. As to the *Synthesis* of these elements, *i. e.* their modes of combination; and

3rd. As to their *Form.*

Having noted the difference of elementary composition, I will now pass to the difference of Synthesis. As the letters of the alphabet acquire new significations with new arrangements, although each letter preserves throughout its integral value, so do the elements acquire new powers by new arrangements. The letters *P o t* may form the word *Pot*, or the word *Top;* so also Carbon, Hydrogen, and Oxygen, in exactly the same proportions, may form *Starch* or *Gum.* It is in conse-

quence, however, of chemists not distinctly appreciating the difference between *elementary analysis* and *immediate analysis* (or, to reverse the problem, *elementary synthesis* and *immediate synthesis*) that so much confusion reigns in this part of science; among other points I will notice that of the pretended impossibility of forming organic substances by artificial means,—an impossibility which is at present owing to our ignorance of the proximate principles and their synthesis. In Müller's *Physiology* we find this note:—

"Berard, Proust, Dobereiner, and Hatchett, believe that they have succeeded in producing organic compounds by artificial processes; but their results have not been sufficiently confirmed. Woehler's experiments afford the only trustworthy instances of the artificial formation of these substances. Woehler discovered that a watery solution of ammonia, after being saturated with cyanogen, contained a considerable quantity of oxalic acid. Again, in the preparation of potassium from charcoal and carbonate of potash, a black mass passes over with the metal, which, when treated with water, yields a large proportion of oxalic acid. Oxalic acid, however, is not regarded as a binary compound of carbon and oxygen; the fact that it undergoes decomposition when its water of crystallization is extracted is no proof to the contrary, for nitric acid is decomposed by the extraction of the last portion of its water. (See Mitscherlich's *Chemie*, p. 416.) Woehler also finds, that urea is obtained in place of cyanide of ammonia when a solution of chloride of ammonia is poured over freshly precipitated cyanide of silver, chloride of silver being formed at the same time. Urea is also formed in the decomposition of cyanide of lead by solution of ammonia. The solution at first contains cyanide of ammonia; but by evaporation of the fluid this salt is converted into urea. In the same way, also, when cyanous acid is mixed with water or liquid ammonia,

cyanide of ammonia is first formed, and thence urea. (Gmelin's *Chemie*, iii. p. 6; Berzelius' *Thierchemie*, p. 356.)"

The point is worth consideration. If you analyse an organic substance into its elementary parts, you cannot again reconstruct the original substance from those elements. True. But the reason is that you have made an *elementary* analysis, and the synthesis required is not elementary, but immediate. The substance was *not* formed of the four organogens and some mineral elements—it was not formed directly of the elements into which it is decomposed—it was formed of proximate principles, and these proximate principles were formed of the elements. In inorganic substances precisely the same difficulty meets us. We can decompose saltpetre into its elements—oxygen, nitrogen, and potassium. But we cannot recompose saltpetre by the *direct* combination of these elements, any more than we can so recompose organic substances; because saltpetre is formed by a synthesis of nitric acid with potass, and not directly. Thus, as Comte remarks in his chapter on Chemistry, Wöhler would never have succeeded in producing urea if he had endeavoured to combine the elements which compose it; he succeeded because he combined its proximate principles.*

An illustration:—There is a favourite game in which a number of letters forming a word to be guessed are thrown together pell mell. These letters may represent the elementary atoms. According as they are arranged in sequence they form the word intended, or some *other* word. My own name, for example, will form Lewes, Sewel, Elwes, Wesel, Weesl, Leews; in a way analogous to that in which the organogens form *isomeric* bodies. All depends on the arrangement, sequence, synthesis.

* Cyanogen and ammonia are organic proximate principles; both have been formed artificially; so that the possibility of forming organic compounds is proved.

Further, be it remarked that among the proximate principles of organic substances there are many of what may be termed mineral origin, whose part is accessory but indispensable; and experiment justifies *à priori* deduction in asserting that in proportion as organic substances contain a large per-centage of these principles, the more do they approach those substances which can be artificially formed; and *vice versâ*. Urine, for example, is formed of a larger proportion of water and salts than of other principles, and contains more than other organic products.

Thus, then, we see that *elementary* analysis can teach us little or nothing of organic substances formed of proximate principles. The value of the elements varies with their varying positions.

As Mulder says, this synthesis is all important: "If we pass in review the substances present in the organic kingdom, we perceive an endless series of combinations from either two, or three, or four elements only. This is enough to show that there is an indefinite capacity for modification in the primary forces which operate in the elements. The influence of one upon another is thus unlimited also. A slight difference in the state of an element is sufficient to give it the appearance of a new, an entirely peculiar, substance, as compared with the other elements. Let us take, for example, starch, gum, sugar, acetic acid, glucic acid, inuline. All these are composed of the same elements, taken in the same proportions. Thus they consist severally in equivalents of

	Carbon.	Hydrogen.	Oxygen.	Water.
Starch	12	9	9 +	HO
Gum	12	9	9 +	HO
Sugar	12	9	9	
Acetic acid $\frac{1}{3}$ ×	12	9	9	
Glucic acid $\frac{4}{3}$ ×	12	9	9 —	$1\frac{1}{2}$ HO
Inuline 2 ×	12	9	9 + 2	HO

"The carbon of one of these substances is no doubt equal to the carbon of any of the others, in so far as it exhibits the same properties, if separated from its combination. But it is incorrect to suppose that the carbon, hydrogen, and oxygen in sugar are identical with those in acetic acid, for there is a great difference between sugar and acetic acid; and we cannot attribute this difference to anything but to the difference of the forces by which the same substance is governed. Thus, the carbon, hydrogen, or oxygen is not in any two cases supplied with the same properties. They assume in each substance a peculiar form. The general idea comprehending carbon, hydrogen, or oxygen in sugar and acetic acid, must therefore be modified, because the forces peculiar to matter must necessarily be modified, as matter is itself unalterable.

"This will appear clearly, if we consider the combinations of carbon with hydrogen. If we supposed the carbon and the hydrogen in C^5H^4, $C^{10}H^8$, $C^{15}H^{12}$, $C^{20}H^{16}$, to be always the same, we should be constrained to assume the identity of the substances, and any distinction would be impossible. Among the elements we know a considerable number which, without entering into any combination, present an entirely different appearance, in consequence of but a slight difference in the circumstances under which they are placed. For example, phosphorus becomes black when heated and then suddenly cooled; and by means of a red heat silica is so modified, that the substance, after and before the application of such heat, might be taken for two different substances, if we looked to its properties only. The interesting experiments recently made by Berzelius as to the allotropic character of phosphorus, have opened a new path for scientific investigations. If the *simple* substances can assume the permanent appearance of unlike bodies, without forming any combination, their compounds can do so much more. And such an assumption of other characters must take place in all

cases, in which no other mode remains of explaining the diversity of the compounds, than in the supposition of a real difference in the component elements themselves."

Our former illustration of letters may help us to an explanation of *isomerism*, which is erroneously supposed to depend on a simple difference in the *grouping* of the elementary atoms, and not on a difference also of synthesis. Thus, in Stöckhardt's work on Chemistry we see isomeric diagrams, in which the atoms are differently arranged, to explain all the differences of phenomena; as if a difference to the eye carried with it all other differences!

Isomeric bodies, properly defined, are bodies having similar elementary composition with dissimilar immediate synthesis; and in proof thereof, they not only form *different* compounds when united with *similar* bodies, bases or acids, but also it is now found they give *different products* when analyzed with sufficient precaution.* It is to be further noted that all these isomeric bodies are bodies having an organic origin; many of them are actually organic, *i. e.*, they are formed of several proximate principles.

There is another difference of composition, and one which demarcates Chemistry from Anatomy with sufficient precision to form of itself a ground for denying the propriety of such a science as Organic Chemistry. The difference I refer to is this: Inorganic substances are *definite* in their composition. Water, for example, whether as water, steam, or ice, is uniformly composed of $12\frac{1}{2}$ ounces of hydrogen to 100 ounces of oxygen. Quicklime, however prepared—from marble, limestone, chalk, or oyster-shells—uniformly contains 250 ounces of calcium to 100 ounces of oxygen. It is on this fact rests the brilliant atomic theory of definite proportions.

* Robin and Verdeil: *Traité de Chimie Anatomique*, i. p. 473.

Not so Organic substances. Those which are specially Organic—those, I mean, which are not crystallizable—are uniformly *indefinite* or *indeterminate* in their composition. That is one of their definitions. No chemical formula, precise in its equivalents, will serve to characterise absolutely an organic substance.

Not only is the elementary composition of organic substances very complex, the immediate composition is so likewise. This immediate composition is not formed of proportions fixed, determinate, invariable, and defined, as in inorganic substances. The organic substance, without losing its distinctive characters of coagulation, &c., may possess a little more or a little less of the elements of water, for example. Elementary analyses do not always give one constant result, as they do in the reduction of inorganic substances; showing that the composition is not definite.

It is because the composition of organic substances oscillates between certain limits (limits, it is true, not very distant) that we are unable to foretell with any absolute certainty what are the molecular acts of combination or of double decomposition which will occur in any given case, as we can with urea, for example. The instability which accompanies this complexity of composition prevents our being certain, after having combined any organic substance with an acid, of finding it precisely as it was before, when we remove the acid by means of a base; as we can with urea and nitric acid. The composition being indeterminate, it is possible the substance may have lost some of its elements, or its immediate molecular composition may have been modified.

How much of this indeterminateness may be mere *mixture*, I do not pretend to say. The distinctive *fact* is all needed for my purpose. The differences resulting from different immediate composition may be seen in Albumen and Fibrine, two substances having exactly

the same elementary composition, and yet two substances so different that no one could confound them. Yet by reagents, or by heat, we can change Albumen into a solid and Fibrine into a liquid, so that the two may be indistinguishable one from the other; and this without altering their elementary composition. Indeed, to use the language of the chemist I have been following, "Ces éléments varient constamment de quantité entre certaines limites pour une même espèce anatomiquement identique, mais prise chez des individus différents, pour une substance dont pourtant tous les autres caractères sont les mêmes. C'est ce qui fait dire que leur composition chimique n'est *pas définie*, n'est pas *déterminée*, parceque leur analyse élémentaire ne donne pas un poids de ces différents éléments fixe et constamment le même, comme le sont les sulfates, l'urée, le sucre,"* &c. Moreover, the nerve-tissue contains phosphorus as a constituent, but the quantity of this phosphorus varies, and yet the tissue remains nerve-tissue whether the phosphorus be more or less; or any other tissue may lose some of its water without losing its properties.

Gathering up these various threads into one formula, we may by it express the second Static Law of Organized Substances:

LAW II. *The presence of higher multiples is accompanied by an indefinite composition in lieu of a definite composition, and by a characteristic immediate synthesis of the elements.*

Before passing to the third and final stage, it will be useful to alter the ordinary classification of matter "Organic and Inorganic," for one which I propose, with great hopes of its being found suggestive, viz.:

Matter may be considered under three aspects: 1st. Non-organized; 2nd. Organizable, or partly organized;

* Robin and Verdeil: *Traité de Chimie Anatomique*, iii. p. 147.

3rd. Organized. For these three conditions I propose the names of *Anorganic, Merorganic*, and *Teleorganic.*

I. *Anorganic matter* is that usually termed inorganic —water, salts, minerals, &c.

II. *Merorganic matter* is matter in an intermediate state, wherein it either wants some addition, to become organized, or else (as in organic products) has lost some of the elements it had when organized. Thus, the *blastema* from which cells are formed is the highest condition of merorganic matter—it is just on the eve of becoming vital. So also the cells which have lost their vitality in the very fulfilment of their function are all merorganic.

III. *Teleorganic matter* is matter in that condition in which the cell, fully equipped, can, and does, perform its function.

From this classification it appears that the passage from *the inorganic to the organic* does not take place *directly;* but the anorganic passes into the merorganic, and the merorganic into the organic. What is the indispensable condition of this final passage? What is it which makes the merorganic substance vital?

We have already considered organic substances under their two preliminary aspects of *elementary composition* and *synthesis* (Laws I. and II.); and, if I have at all succeeded in the exposition, it will not be difficult to gain a clear, firm conception of the third and final process—that, namely, of Form. For Organic matter is differentiated from Inorganic as much by its Form as by its elementary structure.

Before explaining my own view, it will be well to cast a glance at the evidence furnished by crystals:—

Crystallization has always seemed to conceal the first beginnings of the phase named Organic, because in crystals we first meet with *definite constituent forms, i. e.*, with Form as a necessary and inseparable condition of their existence *as* crystals. Inorganic matter can, we know, assume indifferently any shape without thereby

losing its properties. But in a crystal the Form is *essential*—the solution which will become crystallized by even so slight a disturbance of its equilibrium as the touch of a feather, is not yet crystal; it only becomes a crystal when its molecules assume a determinate form.

But there are many obvious and some fundamental distinctions between the highest crystal and the lowest example of organic life, which prevent our accepting crystallization as the transition phase between the inorganic and the organic. Of these distinctions it is enough to name the most striking, viz., the organic cell undergoes a series of transformations, and *reproduces* itself; the crystal undergoes no transformations, and never reproduces.

It is true that a French chemist, M. Brame, has quite recently made a wonderful discovery, which—if it be established—shows that *previous* to crystallization certain bodies assume an embryonic *cellular* condition, the outgrowth and consequence of which is a crystal; and, what is still more remarkable, in this cellular embryo not only has the microscopic cell an enveloping membrane, enclosing within it a soft semitransparent matter containing vapour, which when condensed forms a crystal (thus furnishing both "cell membrane" and "cell contents"), but these cells assume an arrangement very analogous to that of the organic tissues! Granting, however, all that M. Brame claims, his discovery reveals nothing of the passage from the inorganic to the organic—it only enlightens us on the formation of crystals. Instead of showing the crystal as an organic beginning, it shows the crystal as a *consequence* and outgrowth of an organic beginning. We might thus define crystals to be *arrested life.*

Moreover, the results of all researches into the chemistry of organized bodies show that the proximate principles of the organism are disposable into three classes:—

1. Principles of mineral origin which are crystallizable, and which quit the organism such as they entered it.

2. Principles which are crystallizable, formed *in* the organism, and generally quitting it in the shape of excremental products, such as they were at their formation.
3. Principles which are coagulable but *not* crystallizable, formed in the organism with the aid of materials for which the first class serve as a vehicle, and decomposed in the place of their formation, thus furnishing the materials for the principles of the second class.*

These last are the only true organic principles, and are precisely demarcated from the crystallizable principles. We must not, therefore, look to crystals for the element of Form we are now seeking, simply because crystals never attain the teleorganic condition.

Confining ourselves, as we have done hitherto, to the teachings of observation and induction, we have to ask this question: *What is the Form which being universal may be supposed indispensable to organic life?* Half the prosperity of philosophy lies in being able to put a definite question. Interrogate Nature, and she will answer. She answers in this case emphatically—*a cell.* The cell, or sphere, is not only the typical Form of an organic being, that with which every organic being, from the lowest to the highest, commences—it is the indispensable condition of the being's existence.

A cell is the whole of one of the simplest plants, such as the *Protococcus;* and there are large plants which are nothing more than the *association of myriads of such simple cells.* The lowest type is thus a cell; the second stage in advance is an association of cells; the third, a transformation of those cells into a tissue; but in one and every case the starting-point of organic life is the assumption of cellular or spherical form.

On this point hear Mulder:—"The cell is a concave

* Robin and Verdeil.

globule. This concave globule is an individual; that is, in the most simple form in which it can possibly exist (in the lowest moulds), it possesses all the powers of the molecules united into one whole, and thus reduced to a state of equilibrium. This state depends not only on the nature of the substances and of their elements, carbon, hydrogen, and oxygen, or carbon, hydrogen, oxygen, and nitrogen; but also on their form. The state of equilibrium, therefore, could not exist, unless this concave globular form existed. Moreover, this hollow globule possesses the whole of these forces in a state of mutual combination, co-operating for one end; this being a peculiarity which also apparently depends on the globular form. Since these two ideas are founded on pure observation, we may steadfastly adhere to them, and therefore correctly infer that inorganic nature, besides all the peculiarities existing in the carbon, hydrogen, oxygen, and nitrogen, we must suppose, as a chief consequence of this, a tendency to form membraneous, concave, spherical little bodies, in which, because of this form, new peculiar properties manifest themselves, which cannot be brought out by other forms. Thus by matter and form, by form and matter, all that we observe in nature is to a great extent determined. This general conclusion is drawn from the innumerable phenomena we perceive in the organic world—phenomena which differ, whether, on the one hand, the materials are the same and the forms differ, or, on the other, the materials differ, while the forms are the same.

"If, therefore, the vegetable kingdom consisted of one common cellular substance, this being different, however, only as *to the form*, either in various tribes or genera, or species, or parts, or organs of plants; the effects of the same chemical body, of the same cellular substance, must, of necessity, be different for each different form. This has, in fact, been found to be true. These little individuals, these little cells, become other individuals

when different in form, or when connected together in a different manner, though they consist almost of the same substances. The very smallest difference in the nature of the substances they consist of, or with which they are in contact, can infinitely influence that difference of form, and thus the material products of different forms are as innumerable, and as frequently modified, as the different forms produced through their difference in substance are innumerable, and frequently modified. Finally, if the form and substance are constant, the products of the cells must also be constant; if either the form or the substance of the cells differs, these products must be different.

"It is only right, therefore, that they who study the doctrine of life, should set the highest value upon the knowledge of forms, and should not rest satisfied with merely knowing the per-centage of the component parts, or with merely enumerating a series of chemical substances, which appear on the analysis of an organic body, even if it were possible to get only *natural* products by an *artificial* analysis."

There is more in it than Mulder sees; but his observations, combined with what has previously been set forth, may enable the reader to appreciate the final static Law:—

LAW III. *Merorganic substances become teleorganic by the assumption of a Spherical Form.*

The blastema, or nutrient fluid, contains the higher multiples and the proximate principles of indefinite composition, but it is *merorganic*, not *teleorganic;* it is organizable, it is not vital; and the one decisive condition—the only one known—which can transform this blastema into a vital substance is simply *the assumption of a Spherical Form.*

In saying that the passage from the inorganic to the organic is effected by the assumption of the spherical

form (which may stand as a *general* statement of my theory, qualified by what has been said respecting multiples and synthesis), I am really saying no more than what the facts reveal. Its novelty may startle, but what is it more than the mineralogist's explanation of crystallization? Just as the solution becomes a crystal *only* when its molecules arrange themselves in a determinate form, so does the blastema become vital *only* when its molecules arrange themselves in a determinate form.

Not only is this assumption of a Spherical Form the *last* step in the process, but by the loss of that Form the cell loses its peculiar vital characteristic—its reproductive power. I cannot here enter upon the mass of evidence ready to prove this position, but must content myself with the assertion, confident that physiology will show organic substance becomes vital as soon as it assumes the cell form, and ceases to be vital (reproductive), though not ceasing to be organized, with its loss of that form. "It seems established," says Dr. Carpenter, "as the aggregate result of the labours of many observers, that in animals as in plants all the parts in which *active vital changes are taking place essentially consist of cells*, which may be regarded as the real instruments of these operations, the tissues with which they are blended having no other purpose than to supply the physical conditions requisite for them."* If M. Brame's discovery should prove true, this essential activity of the cell will be further illustrated by it. At any rate, sufficient evidence exists to show that the Spherical Form is a *constituent* element of organic life, and I have striven to demonstrate that it is the last determinate step in the passage to vitality.

I have been asked, and shall be asked again, "Whence this Spherical Form? *What* is the cause which deter-

* *Principles of Physiology*, 3rd edit. p. 87. Dr. Carpenter claims this generalization as his own: it is a most important one.

mines these higher multiples to assume the Spherical Form?"

I do not know. The question is one which no positive philosopher will ask; recognizing as he does the impossibility of our ever knowing *causes*. He endeavours to trace the "relations of existence and succession," and is content if he succeed. In the foregoing pages I have endeavoured to trace the statical conditions which characterize organic substances. If they are accurately traced you have no more right to ask me *what causes* the protein compounds to become spheroid, than you have to ask what causes a saline solution to assume a rhomboidal solidity and become crystal. These are ultimate facts; the hieroglyphs no priest can read!

It is not hereby implied that no further and more intimate discovery of the process will be made. I seem to see various avenues opening. When the proximate principles of organized bodies are more accurately known there can be little doubt that we shall arrive at the discovery of certain *properties*, to be classed among the ultimate facts, which will supply details now wanted.

As a specimen of what I mean, the well-known discovery of Ascherson * will serve. In the remarks which follow, however, the reader must understand that we are venturing into the vast region of hypothesis guided by very tremulous lights, and he will consider them as supplementary to my theory, not as constituent parts.

Ascherson found that fat or oil globules in an albuminous solution became coated with pellicles of coagulated albumen; thus presenting, he thought, a type of cell-formation. Now whether this taking on of an albuminous pellicle be a chemical phenomenon, as he and Wittich think, or a purely mechanical phenomenon, as Harting, Melsens, and Panum think, the *fact* is in-

* Kölliker, *Handbuch der Gewebelehre;* and Mulder, *Physiol. Chemie.*

disputable that a globule of fat does envelope itself in a coating of albumen, and thus presents what may be accepted as at least the analogue of the nucleus of a cell, when we remember that fat is an *invariable constituent of the nuclei of all cells animal and vegetable.* So that on the one hand we see a globule of fat has the *property* of enveloping itself in an albuminous coating, which envelope becomes coagulated by the addition of a little water, and thus forms a membranous pellicle for the globule; and on the other hand we see that the nuclei of all cells are globules of fat.

Another indication: The nutritive Chyle is white and opaque, from the presence of innumerable particles of fatty matter of exceedingly minute yet uniform size. They constitute the *molecular base* of Chyle. Their fatty nature is beyond doubt, and the reason of their not running together to form larger drops, as particles of pure oil would, is by many physiologists believed to be because *each molecule is coated with albumen.* Note moreover, that, except these molecules of fatty matter, the Chyle contains no solid or organized substances. The fluid in which they float is albuminous. As the Chyle passes onwards to the thoracic duct the quantity of molecules and oily particles gradually diminishes, and *cells are developed in it*, to which the name of Chyle corpuscles is given.

The process may therefore be thus conceived: A fatty globule surrounds itself with an albuminous pellicle constituting a *nucleus*, which again in its turn surrounds itself with a cell-wall, and this "sphere within sphere" is necessary to the completion of the organic condition; showing, both in respect of Form as in respect of Element, how complexities of function follow upon complexities of structure. Thus the *reproductive* cell is more than a vesicle. It is a vesicle containing a vesicle, which also contains—I will not say a *vesicle*, for that is not proved—but at any rate an *orbicle;* and in cell,

nucleus, and nucleolus, we have a triple sphericity of substances having a physico-chemical differentiation. But it is not the spherical Form alone, nor the proximate principles alone, which constitutes vitality—it is the union of the two.

This point need not be further pursued—we must await more accurate knowledge before attempting to determine what are the details of the process; my object is attained if I have made clear to the reader's mind that—

The passage from the inorganic to the organic is a triple process of differentiation—1. *Of Elements*; 2. *Of Synthesis*; 3. *Of Form*; *and the union of "higher multiples" (in certain determinate conditions named "proximate principles") with "Spherical Form," is the final step which determines vitality.*

The differences, important and minute, which we observe in the myriad phenomena of Organic Life, depend upon minute and important differences in the Synthesis of the Elements and in the Form; every new addition brings with it a new complexity, for every statical difference carries with it a dynamic difference; and thus in an ascending series of evolutions from the simple to the complex, from the anorganic to the merorganic, from the merorganic to the teleorganic, from the simplest stages of the teleorganic to those highly complex manifestations seen in the finest organizations, we learn to gather the phenomena of the universe into one majestic Whole, and learn that all lines of demarcation are subjective only. In a word we learn that Life is an evolution, not a separate creation, and is thus essentially connected with the great Life of the Universe.

No thinking man will imagine anything is *explained* by this. The great mystery of Life and Being remains as inaccessible as ever. But a grander conception of Nature as one Whole, and a more philosophic attitude of mind, in contemplating the varieties of that whole,

will result from the restitution of the homogeneity of Nature, when we learn with Goethe, Schelling, and Coleridge, to see Life everywhere, and nowhere Death.

Be that as it may, I think it indispensable to the true understanding of Biology, that we should familiarize ourselves with the truth, that, between the Inorganic and Organic there is no absolute *essential* difference, but only a great phenomenal difference, arising from the complexity of the lines of direction of force; and also with the necessity—as a scientific artifice—of dividing the so-called Organic Chemistry into Chemistry and Biology.

SECTION XV.

THE SCIENCE OF LIFE.

We now approach the great and intensely interesting Science of Life, improperly called Physiology,—a name which it must continue for some time to bear, because certain quacks with customary ignorance have vulgarized and distorted the term Biology, and applied it, in contempt of Greek and science, to their Mesmeric operations.

Matter endowed with a peculiar property, by us named "vital force;"* having the faculty of *nourishing* itself, of *reproducing* itself, and, in its higher complications, of *feeling;* nourishing itself by a process which is identical throughout the whole series of organized beings—namely, by cellular formation; reproducing itself also by an identical process—cellular fission; possessing, in the animal series, *sensibility* and *locomotion,* in virtue of two special tissues, the nervous and the muscular; exhibiting itself in a wondrous progression of combinations from the structureless cell of the lowest plants up to the complex structure of the highest animals; acting in strict conformity with certain laws, chemical and vital, and so producing all the variety of organized beings; becoming more and more heterogeneous in organs and functions as it ascends the scale; passing through determinate stages of germination,

* It may not be a needless caution to say that whenever I use the phrase "vital force" it is as a convenient and popular phrase designating the *special* property of one form of matter; not as designating an "entity."

growth, maturity, decline, and death; everywhere indissolubly connected with the great Life of the Whole, and speaking in mysterious hieroglyphics of that "all-encompassing and all-sustaining" Power, the burden and the mystery of which for ever presses on our souls—such is the object of Biology! To it all the other sciences are torches. It is the torch whereby we can look upon the final Social Science.

The study of Man and the study of the external world constitute the eternal two-fold problem of philosophy. As Comte says, each may serve as the point of departure of the other. Hence two radically opposed philosophies—one considering the world according to our *subjective* conceptions—that is to say, explaining cosmical phenomena by the analogies of our sentiments and affections; the other considering man as subordinate to the laws of the external world, and as explicable only by the explanation of the properties of matter recognised in operation in the external world. The former of these philosophies is essentially metaphysical and theological. It rests upon the old assumption of man's mind being the normal measure of all things: it makes *law* the correlate of *idea;* it makes the universe subordinate to man. The second is the scientific or positive philosophy.

That the Metaphysical Method should predominate in the study of Life, long after it has disappeared from Physics, and only lurks in odd corners of Chemistry, every one might have foretold; and accordingly, except in the study of morals, we nowhere see this Method so strikingly illustrated as in Biology, with its "Vital Principle," its "Nature curing herself," and its famous notion of organized bodies being independent of chemical action. Not only are all phenomena of life more complex than chemical or physical phenomena, and hence less easily reduced to simple laws, so that because our scientific knowledge is less perfect, our

metaphysical conceptions have greater scope; but the very fact, that in studying Life we go at once to the source of all Metaphysical Method, explains our being metaphysicians in our treatment of this subject. The very men who would laugh at attempts to discover the "principle of attraction," the "nature of electricity," or the "cause of affinity," content as they are with recording the Laws (Methods) which regulate phenomena, naïvely investigate the "vital principle," the "nature of Mind," the "cause of sensation." It is only of late years, and among the most eminent physiologists, that the study of Life has acquired a decisively positive character.

Every Science has its corresponding Art; because in life all our Thought has an aim in Action, under pain of becoming sterile and fantastic. But although Art is necessary as a primary impulse and concurrent aim to Science, yet at a certain period of advancement it is indispensable that we should accurately separate them. As Comte says, their respective domains are distinct though united: to one belongs knowledge, with *prevision* as result; to the other power, with *action* as result. But as soon as Science becomes fairly constituted, it must pursue its own development without any regard to other aims than those of knowledge. Of this the great Archimedes had a profound sentiment, when he naïvely apologized to posterity for having one instant applied his genius to practical inventions. And our brilliant essayist, Macaulay, shows a profound misconception of the nature of science in his celebrated article on Bacon—the whole purport of which is to show that Science ought to be restricted to its immediate applications. The culture of any one science would have familiarized his mind with the opposite conception, and would have taught him that whatever benefits Science has derived in the way of stimulus and direction from the necessities of the Arts, nevertheless, almost all the great developments of Science

have been due to the purely speculative character it has taken. Man does *not* live by bread alone, thank God! And if the energetic lower impulses are necessary at first to stimulate our higher faculties, yet these faculties once aroused suffice unto themselves!

The object of these remarks is to point out the necessity of separating Biology from Medicine, and consequently of no longer trusting the cultivation of the science to those who practically apply it,—the Medical Profession. If it were proposed to confine the culture of Astronomy to Navigators alone, loud Homeric laughter would greet the proposal; yet those very laughers would see nothing irrational in confiding the culture of Biology to the scanty leisure of the Medical Profession. In vain do we remind objectors that Schwann, Kölliker, Henlé, Owen—indeed, most of the greatest physiologists—are either not members of the medical profession, or little more so than in name—the common prejudice is, that Biology can only be successfully studied by the "profession." But this is an evil which must spontaneously disappear before the advance of Science; especially when we come more distinctly to understand that Biology must necessarily embrace the whole phenomena of organized beings—not simply the phenomena of *human* physiology—but the whole of vegetable and animal physiology, of which the human animal is but the highest and most interesting section. Few will maintain that clinical experience constitutes the pre-requisite to a correct understanding of the vegetable world.

Biology is the Science of Life. And first as to the definition of Life. Bichat, unconsciously determined by the ancient prejudice of living bodies being independent of—and antagonistic to—dead bodies (an error dwelt on in a preceding section) gave a definition, which has attained great celebrity, viz.: "*Life is the sum of the functions by which death is resisted.*" Coleridge properly remarks, that he can discover in it "no other

meaning than that life consists in being able to live;" and, indeed, if Bichat had only steadily considered the indispensable *co-operation* of the medium (or surrounding circumstances in which an organization is placed), *with* the organization itself,—if he had considered how a slight change in external conditions is sufficient to *revive* a dying animal or to *destroy* a living animal, he would never have propounded such a definition, for he would have seen that so far from organic bodies being independent of external circumstances they become more and more dependent on them as their organization becomes higher, so that *organism* and a *medium* are the two correlative ideas of life; while inversely, it is in proportion as we *descend* the scale till we arrive at the most universal of all phenomena—those of gravitation, that the independence of a surrounding medium is manifested. Every change of temperature, every chemical combination, affects the organic body, whereas gravitation is in nowise disturbed by *them*. For the phenomena of attraction we only need simple atoms; for the phenomena of life we want the whole *concourse* of nature, and every variation in the medium is followed by a variation in the phenomena. If I insist on this dependence of the *organism* on the *medium*, it is because I find men in their reasonings constantly attaching themselves solely to the subjective, and forgetting the objective point of view—thinking only of the vital force, and forgetting the determinations of that force by external conditions.

Another definition, which has been a favourite with a large class, is this,—"*Life is the result of organization.*" A truly metaphysical definition! Wherefore is life supposed to result from organization, rather than organization from the vital force, whatever it may be?

In that very interesting posthumous essay by Coleridge, *Hints towards the formation of a more comprehensive theory of life*, (our pleasure in studying which

is only abated by its being a shameless plagiarism from Schelling's *Erster Entwurf*, even to its very terminology), there is a definition which, though not wholly unobjectionable, gives a point of view the student will find extremely useful if thoroughly appreciated—and the definition is this, "*Life is the principle of individuation,*" or that power which discloses itself from within, combining many qualities into *one individual thing.* To appreciate this, however, it must be studied in the commentary.

And I do not know where a more intelligible and comprehensive commentary, in brief space, can be found than in the following remarks on the definition:—"To make this definition intelligible, a few of the facts sought to be expressed by it must be specified,—facts exemplifying the contrast between low and high types of structure, and low and high degrees of vitality. Restricting our illustrations to the animal kingdom, and beginning where the vital attributes are most obscure, we find, for instance, in the genus *Porifera*, creatures consisting of nothing but amorphous semi-fluid jelly, supported upon horny fibres (sponge). This jelly possesses no sensitiveness, has no organs, absorbs nutriment from the water which permeates its mass, and if cut into two pieces lives on in each part as before. So that this "gelatinous film," as it has been called, shews little more individuality than a formless lump of inanimate matter; for, like that, it possesses no distinction of parts, and, like that also, has no greater completeness than the pieces it is divided into. In the compound polyp, which stands next, and with which Coleridge commences, the progress towards individuality is manifest; for there is now distinction of parts. To the originally uniform gelatinous mass with canals running through it, we have superadded, in the Alcyonidæ, a number of digestive sacs, with accompanying mouths and tentacles. Here is, evidently, a partial segregation into individualities,—a

progress towards separateness. There is still complete community of nutrition; whilst each polyp has a certain independent sensitiveness and contractility. * * * After complete separateness of organisms has been arrived at, the law is still seen in successive improvements of structure. By greater individuality of parts—by greater distinctness in the nature and functions of these, are all creatures possessing high vitality distinguished from inferior ones. Those *Hydræ* just referred to, which are mere bags, with tentacles round the orifice, may be turned inside out with impunity. The stomach becomes skin, and the skin stomach. Here, then, is evidently no speciality of character; the duties of stomach and skin are performed by one tissue, which is not yet *individualized* into two separate parts, adapted to two separate ends. The contrast between this state and that in which such a distinction exists, will sufficiently explain what is meant by individuation of organs. How clearly this individuation of organs is traceable throughout the whole range of animal life may be seen in the successive forms which the nervous system assumes. Thus, in the Acrita, a class comprehending all the genera above mentioned, 'no nervous filaments or masses have been discovered, and the neurine or nervous matter is supposed to be diffused in a molecular condition through the body.'* In the class next above this, the *Nematoneura*, we find the first step towards individuation of the nervous system. 'The nervous matter is distinctly aggregated into filaments.'† In the *Homogangliata* it is still further concentrated into a number of small equal-sized masses—ganglia. In the *Heterogangliata*, some of these small masses are collected together into larger ones. Finally, in the *Vertebrata*, the greater part of the nervous centres are united to form a brain. And with the rest of the body there has simultaneously taken place just the same process of condensation into distinct systems—

* T. Rymer Jones. † Idem.

muscular, respiratory, nutritive, excreting, absorbent, circulatory, &c., and of these again into separate parts, with special functions. The changes of vital manifestation associated with and consequent upon these changes of structure, have the same significance. To possess a greater variety of senses, of instincts, of powers, of qualities,—to be more complex in character and attributes, is to be more completely distinguishable from all other created things, or to exhibit a more marked individuality. For, manifestly, as there are some properties which all entities, organic and inorganic, have in common, namely, weight, mobility, inertia, &c.; and as there are additional properties which all organic entities have in common, namely, powers of growth and multiplication; and as there are yet higher properties which the organic entities have in common, namely, sight, hearing, &c., then those still higher organic entities possessing characteristics not shared in by the rest, thereby differ from a larger number of entities than the rest, and differ in more points,—that is, are more separate, more individual. Observe, again, that the greater power of self-preservation shown by beings of superior type may also be generalised under this same term—a "tendency to individualism." The lower the organism the more is it at the mercy of external circumstances. It is continually liable to be destroyed by the elements, by want of food, by enemics; and eventually is so destroyed in nearly all diseases. That is, it lacks power to preserve its individuality; and loses this, either by returning to the form of inorganic matter, or by absorption into some other individuality. Conversely, there is strength, sagacity, swiftness (all of them indicative of superior structure), there is corresponding ability to maintain life—to prevent the individuality from being so easily dissolved; and therefore the individuation is more complete.

"In man we see the highest manifestations of this tendency. By virtue of his complexity of structure, he

is furthest removed from the inorganic world in which there is least individuality."*

Although wandering from Comte by these remarks, I am still keeping within the necessities of an exposition of the Positive Philosophy; and the reader will now perhaps better appreciate what follows.

The only definition which seems to Comte capable of fulfilling all the multifarious conditions required, is the one proposed by De Blainville, viz.: *Life is the twofold internal movement of composition and decomposition, at once general and continuous.* "That luminous definition," he says, "seems to me to leave nothing to be desired, unless it be a more explicit indication of the two fundamental correlative conditions inseparable from a living being,—an *organism* and a *medium*. This, however, is but a secondary criticism. The definition presents the exact enunciation of the sole phenomenon rigorously common to the *ensemble* of living beings, considered in all their constituent parts, and in all their modes of vitality." At first sight, it may appear that this definition does not sufficiently respect the capital distinction so much insisted on by Bichat and his followers, between *vegetative* life and *animal* life,—in other words, *organic* life and *relative* life, because it seems to refer entirely to the vegetative life. But, deeply considered, this very objection leads to a recognition of the real merit of this definition, by showing how it rests upon an exact appreciation of the biological hierarchy. For it is indisputable that, in the immense majority of organized beings, *animal* life is but a supplement, an additional series of phenomena, superposed on the fundamental *organic* life. And if, in the progressional ascent of being, we find what was at first the mere addition, become, at last, the most important, so that the vegetative life in Man

* Herbert Spencer: "*Social Statics*," p. 436.

seems destined only to sustain the animal life, his moral and intellectual attributes becoming the highest functions of his existence, that remarkable fact does not affect the order of biological study, but points to another fundamental science,—Sociology,—which takes its rise from Biology. Thus, with reference to the Science of Life, it remains true that the earliest forms are vegetative, and to them the study of animal life must be subordinate; this is so in virtue of the greater generality of vegetative life, and also, according to the remark of Bichat, because the vegetative life is *continuous*, whereas the functions of animal life are *intermittent*.

Between these two forms of life there is indeed a capital distinction, viz. the one just alluded to of the *intermittence* of animal functions and the *continuity* of the vegetative functions, "and to complete this idea we must connect with it the double law of *exercise* which belongs only to animal life. The continuity of the vegetative functions excludes all satisfaction, even supposing the presence of sensitive nerves, because every pleasure requires for its existence something of the nature of comparison. It is in virtue of its intermittence that the two-fold animal property, passive and active, admits of the feeling derived from exercise, and creates the desire of repetition. In the second place, this repetition developes another attribute which cannot belong to continuous functions—the faculty of Habit, which constitutes the necessary basis of individual amelioration."*

* Comte's "*Politique Positive*."

SECTION XVI.

SCOPE AND METHOD OF BIOLOGY.

It will now be possible to venture on a definition of the Science of Life, and a circumscription of its scope and Method. We have seen that the idea of Life presupposes the constant correlation of two indispensable elements, an *organism* and a *medium* (understanding by *medium* the whole of the surrounding circumstances necessary to the existence of the organism). From the reciprocal action of these two elements result all the phenomena of life. Hence it follows that the great problem of Biology is to establish for every case, by the smallest possible number of invariable laws, an exact harmony between these two inseparable powers—the vital conflict and the act which constitutes it; in other words, to connect the twofold idea of *organ* and *medium* with that of *function*. Thus, positive Biology is destined to connect, in every determinate case, the anatomical with the physiological point of view, the static with the dynamic condition. It is this which constitutes its true philosophic character. Placed in a given set of circumstances, every organism must always act in a determinate manner; and inversely, the same action cannot be identically produced by organisms really distinct. So that we may infer the agent from the act, or the act from the agent. The *medium* being presupposed as thoroughly known, in consequence of the results attained by the Preliminary Sciences, the twofold biological problem may thus receive its formula:—

Given the organ or the organic modification, to find the function or the act, and reciprocally.

That Biology is far from a state of positivism to admit of such scientific prevision, except in minor cases, no person familiar with the science need be told. This was still more the case at the time Comte published his views, viz. in 1838. And although in the first volume of his *Politique Positive*, published in 1851, he alludes to the important discoveries of Schwann, relative to the "cell doctrine," it is plain that he has not followed with much attention the rapid course of physiological investigation. I mention this for the sake of those who are about to study his work. Not that the present state of the science in any way modifies the general philosophic considerations he has set forth with such profound and exhaustive insight. What Buffon said of Pliny may be truly applied to Comte: he has *cette facilité de penser en grand qui multiplie la science*—"that capacity for large generalizations which enriches science."

The definition of the science given, let us now examine its Method. The philosophic law, laid down by Comte, respecting the *augmentation* of our scientific resources according as the phenomena become more *complicated*, receives in Biology an unequivocal illustration. If the phenomena of life are incomparably more complex than those of the inorganic world, our means of exploring them are also more extensive. He has already pointed out the three capital arts of exploration, viz., Observation, Experiment, and Comparison; and he proceeds to show at great length how these three arts are employed in Biology.

Of Observation, properly so called, we not only find a great extension in the study of life, resulting from the countless variety of phenomena to be observed, but also from the employment of artificial means whereby our senses are raised to an incalculably higher power: such, for example, as the microscope and stethoscope. No one even superficially acquainted with microscopical researches will fail to see their immense importance, in spite of the errors into which the very difficulty of

rightly observing, and the tendency to *see* what they *wish* to *see*, have led inquirers. What would our knowledge of the tissues be without the microscope?

Of Experiment, in the strict sense of the word as used in Physics and Chemistry, there can be but little employment: the *complexity* and *connexity* (if I may coin the word) of the phenomena prevent that indispensable elimination of all the circumstances except the one which we desire to observe; and almost all direct experiments are rendered equivocal by the impossibility of isolating the phenomena. Yet Biology has a kind of experiment peculiar to itself, and rich in indications, viz., the experiments Nature herself makes for us in the various anomalies of organization, and the various abnormal indications which we denominate Disease.

Comparison is, however, the great art of Biology, and Comte is right in devoting to it the great space he does. Instinctively men avail themselves of this fertile source of knowledge; but so little philosophic conviction is there of its paramount importance, that not one physiologist in a hundred conceives himself to be violating scientific Method in beginning and ending his studies with the physiology of man! To begin the study of Euclid at the twelfth book would not be more absurd. Our ascent must be gradual. Taking a broad survey of all its manifestations, we find that Life has two grand divisions —Vegetative and Animal; or, to use Bichat's language, *Organic Life* and *Relative Life*. We see Plants and Animals,—the latter feeding on the former; but we also see that the Animal itself is only distinguished from the Plant by the possession of certain faculties over and above those of Organic or Vegetative life—viz., the faculties of sensation and locomotion. Equally to the Animal as to the Plant are organs of nutrition and reproduction indispensable; and Cuvier's notion of an animal being able to live for a moment by its *Animal* Life alone, betrays a profound misconception of the

nature of Life. As it is the vegetables which supply Animals with food, so in Animals it is the *vegetative* life which supports the *relative* life.

Physiologists have not sufficiently borne in mind that although in Man the Animal Life has a predominance over the Vegetative Life, nevertheless it is only *superposed* on the Vegetative, and can never for an instant be independent of it. Nature presents to us a marvellous procession from the Plant, which has only Organic Life, to the Zoophyte, which exhibits a commencement of Animal Life, up through Animals to Man, with a gradual complexity of organism, and *gradual enhancement of the animal life;* so that from simple processes of assimilation and reproduction our investigation rises to locomotion, sensation, intelligence, morality, and sociality! The great dynamic difference between inorganic and organic—that is to say, the first vital act, is *assimilation;* add thereto the act of *reproduction,* and you have the whole life of a *cell,* the simplest of organisms.

"A cell," says Dr. Carpenter, "in physiological language is a closed vesicle, or minute bag, formed by a membrane in which no definite structure can be discerned, and having a cavity which may contain matter of variable consistence. Every such cell constitutes an entire organism in such simple plants as *red snow* or gory dew; for although the patches of this kind of vegetation which attract notice are made up of vast aggregations of such cells, yet they have no dependence upon one another, and the actions of each are an exact repetition of those of the rest." The cell, in short, is a plant—minute, yet individual—and its powers of reproduction (*i. e.*, of throwing off cells similar to itself,) is so great, that extensive tracts of snow are reddened quite suddenly by the *Protococcus nivalis* (red snow.) "In such a cell," continues Dr. Carpenter, "*every organized fabric, however complex, originates.* The vast

tree, almost a forest in itself—the *zoophyte*, in which we discover the lowest indications of animality—and the feeling, thinking, intelligent *man*—each springs from a germ that differs in no obvious particular from the *permanent condition* of one of those lowly beings."

Although we use the phrase "Vegetative Life," we must, as Valentin says, guard against the popular error of supposing that the animal and vegetable kingdoms correspond in all particulars; "that there is a digestion, a respiration, a perspiration, and an excretion in plants as well as animals. A more accurate examination teaches that this is not the case. Vegetables possess no tissues which allow of the same kind of nutritive absorption, of distribution of juices, or of secretion, that we meet with in at least the higher animals. They have no large cavities in which considerable quantities of food can be collected, and dissolved by special fluid secretions. They possess no point midway in the movement of their juices, and no mechanism other than that of a casual and secondary apparatus for the inhaustion or expulsion of the respiratory gases. They are devoid of the changeable epithelial coverings which play an important part in many of the animal excretory organs. In one word, the general organic functions are introduced into the two living kingdoms of nature, and probably even into their subordinate divisions, by two different ways. This difference leads at once to the conclusion, that the structure of the animal is not a simple repetition of that of the plant, with the addition of a series of new apparatus. The nature of the tissues, the mode of their action and change, the form, division, and destiny of the organs,—all these rather teach us that animals of any development are constructed upon an altogether different plan."*

I point to this identity of the biological series, and to

* *Text-Book of Physiology*, translated by W. Brinton.

the necessity of the processional method of studying the series, for the sake of making more apparent the indispensable method of *comparison*. Only by studying the varieties of the organism, as manifested in its increasing complexity of structure and intensity of power, can we rightly appreciate it. Cuvier well says, that the examination of the comparative anatomy of an organ, in its ascending gradation from the simplest to the most complex state (or, as he and the majority of the French writers prefer to study it, in the descending degradation, from the most complex to the most simple,) is equivalent to an experiment which consists in removing successive portions of the organ with a view to ascertain its essential part. Take, for example, the ear. The essential part is unquestionably the vestibule; all the other portions, the semicircular canals, the cochlea, the tympanum and its contents, are successive additions corresponding with the increasing perceptive powers.

Comparative Anatomy is therefore the basis of Philosophical Anatomy, and before we can understand the Laws of Life it is indispensable that we embrace the whole variety of vital phenomena: a stupendous task, and one which, with Comte, we may justly regard as one of the greatest testimonies to the power of man's intellect.

It is requisite, says Comte, to distinguish the diverse aspects in which biological comparison may be viewed. First, Comparison between the various parts of each organism; Second, Between the sexes; Third, Between the diverse phases presented in the ensemble of development; Fourth, Between the races or varieties of each species; Fifth, Between all the organisms of the hierarchy.

Every one who has made any extensive biological research will have felt the necessity for a constant recurrence to the comparative method; and I would point also to the equally fundamental law of *assimilation* as

an appreciable illustration. Seeing that the first example of transformation of inorganic into organic matter takes place in vegetable assimilation, and that all the subsequent transformations into higher tissues are but modifications of that one process, it is clear that the elementary laws of assimilation may more easily be detected in the vegetable than in the animal world.

SECTION XVII.

PHILOSOPHICAL ANATOMY.

HAVING indicated, though briefly, the most important generalities with respect to the object, scope, and Method of the study of living beings, we may now glance at Comte's division of the subject into its statical and dynamical elements,—Anatomy, comparative and descriptive, and Physiology.

Anatomy was enveloped in inextricable confusion so long as it proceeded only with a view to organs, and groups of organs. Bichat, by his grand philosophical device of decomposing the organism into its various elementary *tissues*, rendered Anatomy the greatest of services. For although a profound investigation of the whole animal kingdom, proceeding on the ascensional Method from the lowest upwards to man, will reveal to us the various tissues successively emerging into special distinctness as the diverse functions become more and more pronounced; nevertheless, this discovery would have necessarily been much slower, had it not been for Bichat's philosophic innovation,—as indeed may be seen in the fact of Cuvier, although coming after Bichat, having never familiarized his mind with the importance of this view, but continuing to occupy himself with the organs and groups of organs, hoping *there* to read the answer to his questions. The organs themselves are made up of tissues, and therefore the priority of the tissues is beyond dispute.

This, then, is the order laid down by Comte in conformity with his method of proceeding from the general

to the special, the simple to the complex. *We must commence with the study of the tissues, and thence proceed to the analysis of the laws of their combination into organs, and finally, to the consideration of the grouping of those organs into systems.*

A slight rectification of this order is necessary, and a disciple of Comte's—Dr. Ségond—in his *Systématisation de la Biologie*, has suggested it. He says we should precede the investigation of the tissues by that of the *proximate principles*,—viz., the phosphates, fats, salts, albumen, &c. These, combined with the "anatomic elements" (cells, fibres, tubes), constitute the Organic Elements,—that is to say, the elementary constituents of organic matter. For a thorough investigation of this subject, and at the same time for the most exhaustive application of the positive Method in elementary Anatomy, the philosophic biologist is referred to the large work of Drs. Robin and Verdeil—*Traité de Chimie Anatomique.*

That the starting point of all the tissues is the *Protein* of Mulder, no organic chemist now doubts, although the existence of this protein, which Mulder fancied he had discovered, is generally given up. But although it is probable that no such basic combination of the four organogens does actually exist, the conception—as a philosophic artifice—is too useful to be disregarded; and anatomists speak, therefore, of protein as a brief expression for the four organogens. In fact, this conception is only an application to organic bodies of the conception of *Compound Radicals;* and we may employ it as we employ the conception of radicals in inorganic chemistry, without necessarily believing in their objective existence.*

We trace the transformation of this protein into Albumen, Fibrine, and Caseine, by the additions of certain proportions of sulphur, or phosphorus, or of both,

* See on this point Robin and Verdeil, *Traité de Chimie Anatomique*, vol. i. p. 648.

as a preliminary to our investigating the transformation of the cellular tissue into the other tissues. Herein we see the intimate relation of Biology with Chemistry. And, while on this point, let us note the chemical analysis of these *elements* given by Mulder.

Observe that Protein, the parent of all, is assumed to be composed solely of the four *organogens*, and in this proportion in a hundred parts:—

Nitrogen	16·01
Carbon	55·29
Hydrogen	7·00
Oxygen	21·70
	100

For Albumen we want slight additions—very slight—of sulphur and phosphorus, replacing a slight loss of Nitrogen and Carbon.

Nitrogen	15·83
Carbon	54·84
Hydrogen	7·09
Oxygen	21·23
Phosphorus . . .	0·33
Sulphur	0·68

For Fibrine we want the same materials as for Albumen, with slight variations in proportion:—

Nitrogen	15·72
Carbon	54·56
Hydrogen	6·90
Oxygen	22·13
Phosphorus . . .	0·33
Sulphur	0·36*

* I have given the analysis of Mulder; the reader will bear in mind, however—1st, that this is the *elementary* analysis; 2d, that the composition of organic substances is essentially *indefinite*, though varying within certain limits.

Having settled the order to be—Proximate principles, Elements, Tissues, Organs, and Groups of Organs or Systems—we have to trace the transformation of all the tissues from one, and their classification according to their true general relations.

After pointing out the value of De Blainville's distinction between the organic *elements* and organic *products*, Comte opens the question of the vitality of organic fluids.

"A glance at the ensemble of the organic world shows us clearly that every living body is continually formed out of a certain combination of solids and fluids, of which the proportions vary acording to the different species. The very definition of life presupposes the necessary harmony of these two constituent principles. For this *twofold internal movement of composition and decomposition* which essentially characterises life, cannot be conceived in a system altogether solid. On the other hand, independently of the impossibility of a purely liquid mass existing, without being contained by some solid envelope; it is clear that such a mass could not be organized, and life, properly so called, becomes unintelligible in such a mass. If these two parent ideas of life and organization were not necessarily co-relative and, consequently, inseparable, one might conceive that life essentially belonged to the fluids, and organization to the solids. Indeed, the comparative examination of the principal types seems to confirm as a general rule, that vital activity augments essentially in proportion as the fluids predominate in the organism, while, on the contrary, the increasing preponderance of the solids determines a greater persistence of the vital state. These reflections prove that the celebrated controversy on the vitality of fluids rests on a vicious position of the problem altogether, since the necessary co-relation between fluids and solids excludes, as equally irrational, either the absolute *humorism* or absolute *solidism*.

"Nevertheless, in considering the various proximate principles of the organic fluids, there is one series of positive researches to be made respecting the veritable vitality of the organic fluids. For example, the blood being formed principally of water, it would be absurd to suppose this inert vehicle as participating in the incontestible vitality of the blood; but wherein lies this vitality? The microscopic anatomy of our day (1838) has answered this question by making the red globules the seat of vitality, they alone being organized. But this solution, precious though it be, can only as yet be considered as a simple sketch of the truth. For it is admitted that these globules, though always of determinate form, become narrower and narrower as the arterial blood passes into the inferior vessels,—that is to say, in advancing towards the seat of its incorporation with the tissues; and finally, that at the precise instant of definitive assimilation there is a complete liquefaction of the globules. Now this seems in open contradiction with the hypothesis, since here the blood would cease to be vital at the moment of its accomplishing its greatest act of vitality."

The net result of this examination of the vitality of the fluids, together with some other observations for which there is no space here, is, that Comte would begin the static investigation with the solids, as best representing the idea of organization, and from the solids pass to the fluids.

Thus we arrive once more at the tissues as the anatomical starting-point. And here, as elsewhere, the immense importance of Comparison stands prominent, the earlier phases of human development being too rapid and too removed from observation for Anatomy to get its clue there; only in the biological hierarchy, embracing *all* organized beings, can we look for decisive indications. Following this Comparative Method we find that the *cellular* tissue is the primary and essential

basis of every organism, being the only one universally present. All the various tissues which in man seem so distinct, successively lose their characteristic attributes as we descend the scale of organisms, and always tend to lose their identity in the cellular tissue, which, as we know, remains the sole basis of the vegetable world, and also of the lowest forms of the animal world.

"We may remark here," says Comte, "how the nature of such an elementary organization is in philosophic harmony with that which constitutes the necessary basis of life in general, reduced to its abstract terms. For under whatever form we conceive the cellular tissue, it is eminently fitted, by its structure, to that *absorption and exhalation* which form the two essential parts of the great vital phenomenon. At the lowest stage of the animal hierarchy, the living organism, placed in an invariable medium, is really limited to absorption and exhalation by its two surfaces, between which circulate the fluids destined to be assimilated and those resulting from disassimilation. For a function so simple the simple cell is sufficient."

Having ascertained that the cellular tissue is the primordial tissue successively modified into other tissues, we have to trace the order of succession; and here Comparative Anatomy again comes to our aid, and guides us by this simple luminous principle—that the secondary tissues are to be regarded as more widely separated from the primary tissue, just in proportion as their first appearance takes place in the more special and more complex organisms. For example, the nervous tissue is totally absent from all vegetable organisms, and is undiscoverable in the lowest forms of animal organisms, by Owen named, in consequence, *Acrita*. Again, in the muscular tissue there are two distinct varieties, the *striped* and *unstriped* fibres; the former peculiar to the voluntary or more complex muscles, the latter to the involuntary muscles. But the latest researches show

that as we descend the animal hierarchy we find the distinctive characters of these fibres gradually merging together. The transverse stripes grow irregular instead of parallel; the fibres possess them only near the centre, where the development is greatest, and the contractile energy most active.

The modifications which the cellular tissue undergoes may, in general, be divided into two classes: the most ordinary and least profound are those of simple structure; the other, more profound and more special, affect the very composition of the tissue itself.

"The most direct and general of these transformations generates the dermal tissue, properly so called, which constitutes the basis of the organic envelope, external and internal. Here the modification is reduced to a simple *condensation*, varying according as the surface has to be more *absorbent* or *exhalant*. This transformation, simple as it is, is not rigorously universal; we must ascend to a certain stage of the biological scale before perceiving it distinctly. Not only in the majority of the lower animals is there no essential difference between the external and internal surfaces, which can, as is well known, mutually supply each other's places; but if we descend a little lower, we are unable to discern any anatomical distinction between the envelope and the ensemble of the organism, which is wholly cellular.

"An increasing condensation, more or less equally distributed, of this cellular tissue, determines—in starting from the dermal tissue, and in a higher stage of the organic series—three distinct but inseparable tissues, destined to play an important part in the animal economy, as the protective envelopes of the nervous system, and as auxiliaries to the locomotive apparatus. These are the *fibrous*, *cartilaginous*, and *osseous* tissues—the fundamental analogy of which is evident, and has led M. Laurent, in his scheme of systematic

nomenclature, to fix this analogy by the application of the general term *sclerous* tissue to the three. The propriety of this is the more evident, because, in reality, the different degrees of consolidation result from the deposit of a heterogeneous substance, either organic or inorganic, in the network of the cellular tissue, and the extraction of this substance leaves no doubt whatever as to the nature of the tissue. When, on the contrary, by a final condensation, the primary tissue becomes more compact, without encrusting itself with any foreign substance, then we pass to a new modification, where impermeability becomes compatible with elasticity, which characterizes the *serous* tissue, the destination of which is to interpose itself between the various organs, and above all to contain the fluids of the body."

These are the tissues necessary to Organic life; and as Animal life is so markedly distinguished from Organic life, we may be prepared for some equivalent distinction in the modification of the tissues proper to Animal life,—viz., the *muscular* tissue and the *nervous* tissue. In each case the modification is characterized by the anatomical combination of the fundamental cellular tissue with a special *organic element*, which, of course, affects its whole composition. In the case of the muscular tissue, the organic element is that well known as *fibrine* (the analysis of which has already been given), and in the case of nervous tissue, the element is that named by De Blainville *neurine*. The modification now spoken of is too great for us in the present state of science to describe with precision; but no philosophical anatomist will doubt the reality of the process, unless he prefer the supposition of three *primitive* tissues,—cellular, muscular, and nervous,—a supposition which would disturb the whole unity of Nature.

This, then, is the object of Philosophical Anatomy:—

to reduce all the tissues to one primordial elementary tissue, from which they are developed by modifications more and more special and profound, first of structure and then of composition.

Comte energetically raises his voice against that tendency among modern German anatomists to quit the real positive point of view for some more inaccessible and chimerical position, which, if attainable, would only remove the subject still farther, and in no case explain it. Instead of contenting themselves with the reduction of all the tissues to one, they endeavour to reduce that one to an assemblage of *organic monads,* which are the primordial elements of all living beings. This is contrary to all sound Biology. In the science of life what have we to study but the phenomena of organized beings? To go beyond the organism is to step beyond the limits of the science. That the differences between the inorganic and organic worlds are *phenomenal,* and in no wise *nomenal,* I have endeavoured to prove in the sections on Organic Chemistry; but these *phenomenal* differences are in philosophy essential, and whoever confounds them sins against fundamental principles.

In one sense it is true that Life is everywhere; but in the restricted sense in which Biology considers Vitality —viz., as the co-relation of two inseparable ideas, Life and Organization—it is obviously absurd to suppose Life as resident in molecules. In what could the *organization* or the *life* of a monad consist? "That the philosophy of inorganic matter should conceive all bodies as composed of indivisible molecules, is rational enough, being perfectly conformable to the nature of the phenomena, which, constituting the general basis of all material existence, must necessarily belong to the smallest particles. But, on the contrary, this biological heresy is only an absurd imitation of that conception, and, reduced to plain terms, it supposes all animals to be com-

posed of animalcules. Even admitting this supposition, the elementary animalcules become more incomprehensible than the animals, not to mention the gratuitous difficulty introduced of their association into one animal.

In thus objecting to the doctrine of monads, Comte must not be supposed to allude to the *cell-doctrine*, which, at the time he wrote, did not exist. He merely wishes to keep the unity of each organization distinct. "Any and every organism constitutes by its nature an indivisible unit; it is true that by an intellectual artifice we can decompose that unit the better to understand it; but the last term of that abstract decomposition consists in the idea of tissue, beyond which (if we combine with it the idea of elements) nothing can anatomically exist, because beyond it there can be no organization. The idea of *tissue* is to the organic world what the idea of *molecule* is to the inorganic."

I know not if the "general reader" has been able to follow this abstract statement of the fundamental principles of philosophical Anatomy, but he need only open any of the works specially devoted to this science, and he will perceive at once the simplicity, profundity, and luminousness of the principles Comte has laid down.

SECTION XVIII.

VITAL DYNAMICS.

To the analysis of the fundamental statical condition of living beings, succeeds the co-ordination of all known organisms into one hierarchy; in other words, to Anatomy succeeds zoological Classification. The chapter devoted to this subject by Comte is full of interest, but I must pass it over with a mere indication. He decides against Lamarck's celebrated development hypothesis. Although his admiration of Lamarck, and appreciation of his influence on philosophical zoology, is such as may be expected from so great and liberal a thinker, he does not, as it appears to me, fully appreciate the immense value of this hypothesis if merely treated as a *philosophic artifice*, let its truth be what it may.

Having set down the general consideration necessary as a prelude to classification, Comte commences his survey of the *dynamical* conditions of Biology; or what in common parlance is termed Physiology, as distinguished from Anatomy.

Physiology first demands a fundamental division into Vegetative Life and Animal Life, corresponding not only with the two kingdoms Vegetable and Animal, but with the twofold life of every animal—viz., the organic life and the relative life. The Vegetative, as more simple, more general, and first in the order of time, demands priority in study; the animal depends upon the vegetable, the vegetable does not depend upon the animal. Now in the phenomena of Vegetative Life we see very distinctly the co-operation of all those laws of inorganic matter which the previous sciences have made us ac-

quainted with; and Comte has sketched what he calls "the theory of media," or indispensable circumstances, as a necessary preliminary* to this part of the science.

"The true philosophic character of physiology consists in the institution of an exact and constant harmony between the static and dynamic points of view, between the ideas of *organization* and the ideas of *life*, between the notion of *agent* and that of *act*; hence results the necessity of reducing all our abstract conceptions of physiological *properties* to the consideration of elementary and general phenomena, every one of which necessarily recalls to our mind the idea of a locality more or less circumscribed. One may say, in short, that the reduction of the various *functions* to corresponding *properties* must be regarded as the consequence of the habitual analysis of life itself into its different functions, setting aside all vain pretensions to discover *causes*, and bearing in view only the discovery of *laws*. Otherwise, the ideas of *properties* will fall back into the ancient notions of metaphysical entities.

"In endeavouring to make our different degrees of physiological analysis correspond with those of anatomical analysis, we may begin by saying that the idea of *property*, which lies at the bottom of the one, must correspond with that of *tissue*, which lies at the bottom of the other; while the idea of *function* corresponds with that of *organ*: so that the successive notions of *function* and *property* present a gradation perfectly similar to that which exists between the notions of *organ* and *tissue*."

It has already been seen, in treating of the tissues, that we must divide them into, 1st, one primordial generative tissue—the cellular; and 2nd, the secondary and special tissues which result from the combination of certain substances with this primary tissue. That is to

* In the *Politique Positive*, he rectifies the position here given to the theory of media, and places it *after* Physiology, on the philosophic principle that intermediate questions should be studied after the two extremes they lie between.

say, there is the cellular tissue and its modifications; and there is the combination of this tissue with *fibrine* and *neurine* to form muscular and nervous tissues. The physiological properties must therefore be divided into correspondent classes—1st, those general properties which belong to all the tissues, and which constitute the life, so to speak, of the primordial cellular tissue; and 2nd, those special properties which characterize the most distinctive modifications—*i. e.*, the muscular and nervous tissues. Thus we return to the great fundamental distinction between Vegetative and Animal Life.

"If," says Comte, "we consider the condition of opinion with reference to this matter, we shall find, that, as regards the two special secondary tissues, very clear and important conclusions have been obtained of their properties, because in accordance with the natural march of intelligence, the most striking phenomena are the soonest appreciated. All the general phenomena of animal life are, now-a-days, unanimously connected with *contractility* and *sensibility*, considered each as the characteristic attribute of a distinct tissue. But there reigns extreme confusion and difference with regard to the general properties of vegetative life."

The two capital functions of Vegetative Life are those which, in their constant connection and antagonism, correspond with the definition of Life itself:

1st. *Absorption*, internally, of those materials drawn from the surrounding medium, which, after their gradual *assimilation*, result in what we call *nutrition* or growth.

2nd. *Exhalation*, externally, of those molecules which are not assimilated, or are produced by disassimilation in the waste of tissues.

No other fundamental notion enters the idea of Life, if we separate from it, as we ought, all ideas relative to *animal* life, which, as a more special modification, does not affect the general problem.

"In no organism can the assimilable materials be *directly* incorporated, either at the place of absorption

or under their primitive form; their assimilation requires a certaindisplacement, and a preparation accomplished during the passage. It is the same, inversely, with exhalation, which presupposes that the particles which have become useless to a certain portion of the organism, are finally exhaled from another portion, after having undergone, in the passage, certain indispensable modifications. In this respect, as in so many others, it seems to me that great exaggeration has been made of the distinction between the animal and vegetable organism, the more especially when it has been attempted to make *digestion* an essential character of animality. For, in forming the most general notion of digestion, which must extend to all preparation of aliments indispensable to their assimilation, it is quite clear that this preparation exists in the vegetable as well as in the animal, although less profound and varied, in consequence of the simplicity of the aliments and of the organism. The same remark applies to the movement of the fluids."

To these functions of Absorption and Exhalation (between which we must necessarily interpose *Assimilation*, as the result of absorption), we must add a fourth, which, issuing out of Assimilation, presents three great aspects: Growth, Generation, Death;—all dependent upon cell multiplication, and *varying* according to a law I hope some day to demonstrate, with the aid of my friend Herbert Spencer's discovery, succinctly expressed by him in the formula, *individuation is antagonistic to reproduction.**

It may be well here to state one of the fundamental laws of assimilation, which we owe, I believe, to Chevreul:—

There is an intimate relation between the chemical

* See his *Theory of Population*, an essay reprinted from the "Westminster Review," giving the outline of an elaborate work on which he has long been engaged.

composition of an aliment and the organism which it nourishes.

A plant or an animal may be nourished in two ways: 1st, when attached to the parent as seed or embryo; 2nd, when separated from the parent and drawing its food from the surrounding medium. On analysing the *proximate principles* contained in the seed or egg, we find them belonging to the principal types subsequently found in the developed being. And if—in passing from oviparous to mammiferous animals—we examine the young animal in reference to the milk which for a long while forms its entire nourishment, we find a perfect correspondence between the aliment and the structure. The proximate principles of milk are "fitted to combine molecule to molecule with the principles—exactly corresponding or analogous—already existing in the organs they are to nourish."

If we consider the plant separated from its parent and the animal separated from its parent, we detect at once a capital distinction in their power of assimilating substance from the external world. The plant, simpler in its organization, is able to assimilate water and gas; on the other hand, the manure necessary for its complete development presents organic matters, more or less altered at the moment of entrance.

In passing from the plant to the animal, we observe that the more complex the organization the more complex are the aliments which nourish it, and the more analogous are their proximate principles to the principles of the organs they sustain. Thus we see that plants are nourished by water, carbonic acid, and other gases and organic matters (in the shape of manure, that is to say, reduced to simpler and more soluble principles); on the contrary, animals more complex and more elevated in the organic scale need matters more complex in proximate principles, and consequently more varied in properties.

A slight modification of the foregoing statement is

necessary, and one which leads me to correct an error almost if not quite universal; the error, namely, of supposing that Animals are distinguished from Plants by their inability to nourish themselves directly with the materials furnished by the external world. That Plants can convert inorganic substances into their own substance, but that Animals have no such power—requiring the intervention of plants for that purpose,—is a proposition to be met with as beyond a doubt in every book on physiology.

The proposition is erroneous; it is too absolute. The portion of truth it contains is this: animals cannot nourish themselves solely by materials taken directly from the inorganic world, in the way plants nourish themselves by the air, water, and alkalies directly furnished them.

But does this mean more than that complex structures, by reason of their complexity, cannot be built up in the same way as the simple? If animals were nourished in the same way and on the same materials as plants, we should not find such immense differences between them.

Ordinary experience is sufficient to show—when once the idea is started, and the old assumption which men have received unquestioned, is questioned—that animals, *besides* converting organic substances into their own tissue, do also convert inorganic substances into their own tissue with a precision and an abundance scarcely surpassed by plants. They take the oxygen directly from the air to vitalize their blood; they take the water directly from the spring; they take salts in their food and out of it; they take up iron, and various mineral substances, indirectly, if you will, *i. e.*, in their food; but, nevertheless, if you deprive the food of its inorganic substances the animal will perish. Nay, we see by the example of Birds that chalk is necessary to life. In M. Chossat's experiments, pigeons were deprived of all chalky substances not actually *in* the corn he fed

them with. At first they fattened and grew heavier. At the end of three months they augmented their quantity of drink—as much as eight times their previous quantity. They suffered from diarrhœa *par insuffisance de principes calcaires.* Finally, they died, being utterly unable to sustain life without a certain amount of chalk!

Every physiologist knows the large proportion of inorganic substances in the organic tissues; especially water and phosphate of lime. Water forms nearly eighty per cent. of our bodies; and there is no *evidence* that any portion of this water is formed *in* the body.*

We have only to consider what the Law of Assimilation is, to see at once the real nature of the proposition respecting Animals and Plants. The Law of Assimilation depending on the chemical relation between aliment and structure, it follows that the more complex the structure the more complex must be the food: hence the reason why Animals cannot nourish themselves *solely* with the aliment which suffices for the simpler structures of Plants.

The gradation is as follows:—The simplest plants need only anorganic substances; the *higher* plants need those substances, and also certain merorganic substances, the débris of organic matter—manure.† The lower

* The statement in the text will probably startle those accustomed to consider that oxygen combines with the hydrogen of the food to form water—a pure hypothesis without a single direct observation to support it; but the work of Robin and Verdeil enables me to modify the statement so far as to say, "It is possible and probable, but *only* probable, that *some* water may be formed in the body by double decomposition, though *not* by direct combustion."—*Traité de Chimie Anat.* ii. p. 136—142.

† Since this was in type the *Société de Biologie* has published an abstract of researches, by Verdeil and Rislet, into the composition of the soluble substances extracted from fertile soils, in which it is shown that plants do not nourish themselves exclusively with inorganic materials, but that they also find organic materials prepared for them in the soil; and the reason why artificial manures have failed is the absence of organic principles.—*Mémoires dela Soc. de Biologie*, vol. iv. p. 111—112.

animals need anorganic, merorganic, and teleorganic substances—air, water, salts, plants, &c. The higher animals also need these, but in different proportions—with greater preponderance of the teleorganic in proportion as the organization of the animal is more complex—(Herbivora, Carnivora). So that we must modify Comte's definition of animals, "organized beings nourished by matters which have once lived," as distinguished from Plants, "organized beings nourished by matters which have not lived," and insert the word *mainly* into the definition.

Following out this Law of Assimilation, we see the reason of the results obtained by Magendie, viz., that no organic substance will by itself suffice for aliment; nor, indeed, will all the organic substances together suffice if deprived of the other proximate principles, *i. e.* the inorganic. It is obvious that the body, which is composed of three classes of principles, cannot be nourished by an aliment containing only one of these. Hence the fallacy of Liebig's celebrated argument respecting the non-nutritive properties of gelatine—an argument moreover in direct contradiction with the principles he has himself laid down; gelatine alone is not nutritive, nor is albumen alone, nor fat alone, nor salts alone.

Finally, it is owing to the relation between Aliment and Structure that the organism separates the food into two portions, one of which it absorbs into its interior, the other it rejects as unfit for use. And we trace the operation of the same law in the formation of the special tissues. The blood is the blastema from which one and all select their nourishment; but each selects that only which bears the due relation to it.

SECTION XIX.

VITAL DYNAMICS: MATERIALISM OR IMMATERIALISM?

In passing from the study of the *functions* of Organic Life, to the more complex phenomena of *results*, we enter a new, a more difficult field; and one in which the present state of the science is necessarily less perfect. For to take the most immediate result, that, namely, which consists in the state of simultaneous and continuous composition and decomposition, characteristic of Vegetative Life, how can it be thoroughly analyzed, while assimilation on the one hand, and the secretions on the other, are so imperfectly studied? Or, passing to the question of animal heat, which may be considered as a second result of the spontaneous action of bodies to maintain, within certain limits, their necessary temperature, in spite of the thermometric variations of the ambient medium;—this, also, has to be correctly analyzed. Considered under their most general aspect, the production and preservation of animal heat result from the ensemble of the physico-chemical acts which characterize organic life; so that every living body presents a real chemical laboratory, capable of spontaneously maintaining its temperature, as a consequence of the phenomena of composition and decomposition, without regard to external temperature. And what is said of Heat applies equally to Electricity: the undoubted presence and participation of which in the organism has led to so many chimerical hypotheses on the supposed identity of electricity with the Vital Force, with nervous action, &c.

From the study of Organic Life, we pass to that more complex and special class of phenomena called Relative or Animal Life. And in conformity with the philosophic rules already laid down, our first object must be to ascertain what are its fundamental and distinctive phenomena: they are *locomotion* and *sensation*, dependent upon two fundamental properties, *contractility* and *sensibility*, belonging to two peculiar tissues, the *muscular* and the *nervous*. In those few words the whole subject is resumed. The positive biologist recognizes in *contractility* and *sensibility* two special and distinctive *properties*, which must be accepted—at any rate provisionally—as ultimate facts, no more admitting of question or of explanation than the ultimate facts of gravity, heat, &c. The value of this distinction I cannot hope will be appreciated without some further elucidation; and its capital importance induces me to dwell on it awhile.

Comte remarks—and the remark is immensely significant—that the discovery of gravitation, the first great acquisition of positive Physics, was contemporaneous with the discovery of the circulation of the blood—the first fact which rendered positive Biology possible; and yet what immense inequality in the progress of the two sciences since that day when the starting-point of both was reached! Nor is this inequality *solely* and directly owing to the greater complexity of Biology; but also to the philosophic Method which presided over the evolution of Physics, compared with the vague metaphysical Method which has not yet ceased in Biology—a consequence, let me add, of that very complexity. No one inquires into the *nature* of gravitation, or into its *cause*; to detect its *law* is deemed sufficient; but physiologists are incessantly inquiring into the *nature* and *cause* of contractility and sensibility, unable as they are to conceive these phenomena as two ultimate facts—properties of two special tissues. The only distinction to be drawn between these vital properties and the general physical

properties is, that they are more *special;* but this speciality does not make them more explicable, for it is always in exact harmony with the corresponding speciality of the structure: it is *only* muscular tissue (or, more rigorously stated, it is only Fibrine) which presents the phenomenon of contractility; it is *only* nervous tissue which presents the phenomenon of sensibility. All those physical and chemical hypotheses which have been invented to explain contractility and sensibility, have been as unphilosophic as the ancient efforts to explain gravitation and chemical affinity. For, as Comte truly says, after all they only represent vaguely the mechanical transmission of impressions produced on the nervous extremities, but do not in any degree explain *perception,* which thus remains evidently untouched, although it is really the most essential element of sensation.

A certain vague sense of the vanity of these attempts to explain the phenomena of sensation has caused an indignant reaction on the part of metaphysicians, and by enlisting the prejudices of the majority against what is styled *Materialism,* has very seriously obstructed the tranquil path of inquiry. Every one feels an intense conviction that sensation and thought are *not* electricity, are *not* mere vibrations, are *not* "secreted by the brain as bile is secreted by the liver." He knows that sensation is unlike all other things. He needs no revelation of Science to tell him that it is different from electricity; and intimately persuaded of its *speciality,* he lends a willing ear to any harmoniously-worded explanation offered by the metaphysician as to its being an "immaterial principle," an "o'er-informing spirit," a mysterious *something* which, whatever it may be, is assuredly *not* "blind unconscious matter."

Positive philosophers have often called the quarrel been Materialism and Immaterialism a frivolous and vexatious dispute about words. But it is more than that. Though men squabbled about words, there were

fundamental ideas working under them antagonistically; and, on the whole, I think the metaphysicians had more reason on their side than we on the other gave them credit for. Absurd as their "immaterial principle superadded to the brain" must be pronounced, it had this merit, that it kept the distinctive *speciality* of the phenomena of sensation in view, and preserved it from the unscientific hypotheses of some materialists.

That "blind unconscious matter could not think," was held as a victorious argument, in spite of the assumption implied in the epithets (for the aphorism amounts to this,—blind matter cannot see, unconscious matter cannot be conscious.) To any one who looks steadily at the question, however, it may be shown that, as a matter of fact, the nervous tissue, and *that* only, being sensitive, the biological proposition simply is: "sensitive matter can be sensitive." To claim for this nervous tissue any superadded entity named Thought, is to desert the plain path of observation for capricious conjecture. As well call Strength an immaterial principle superadded to muscular tissue. The muscular action and the nervous action are two special phenomena belonging to special tissues. Science can tell you no more. If your mind is dissatisfied therewith, and demands more recondite explanation, invent one to please yourself, and then invent one for heat, for attraction, for every phenomenon you conceive; the field is open; imagination has wide-sweeping wings; but do not palm off your imagination as Science!

What the metaphysician says in respect of the essential *speciality* of the phenomena of thought and sensation—their complete distinction from other physical phenomena—is therefore to be admitted as true. He builds on this basis an absurd superstructure; but the basis we cannot destroy. On the other hand, what the physiologist says respecting the identity of thought and nervous action is equally indestructible. That is his basis. Combine the two schools into one, and you have the

Positive Philosopher who says, "Sensibility is an ultimate fact, not explicable, not to be assigned to a knowable cause, but to be recognized as the property of a special tissue—the nervous."

Physiological writers on this subject are in a strange dilemma. Their facts and conclusions all tend to show the dependence of thought upon the nervous system; while their old prejudices, fortified by the absurd hypotheses and confusions of Materialists, forbid their adopting such a proposition in its naked rigour. Thus Todd and Bowman in their excellent work speak plainly enough:—

"From these premises it may be laid down as a just conclusion, that the convolutions of the brain are *the centre of intellectual action*, or, more strictly, that this centre consists in that vast sheet of vesicular matter which crowns the convoluted surface of the hemispheres. This surface is connected with the centres of volition and sensation (corpora striata and optic thalami), and is capable at once of being excited by, or of exciting them. *Every idea of the mind is associated with a corresponding change in some part or parts of this vesicular surface*; and, as local changes of nutrition in the expansions of the nerves of pure sense may give rise to subjective sensations of vision or hearing, *so derangements of nutrition in the vesicular matter of this surface may occasion analogous phenomena of thought, the rapid development of ideas*, which, being ill-regulated or not at all directed by the will, assume the form of delirious raving."

Elsewhere they say:—

"*Although the workings of the mind are doubtless independent of the body* (?), experience convinces us that in those combinations of thought which take place in the exercise of the intellect, the nervous force is called into play in many a devious track throughout the intricate structure of the brain. How else can we explain the bodily exhaustion which mental labour induces?

The brain often gives way, like an overwrought machine, under the long-sustained exercise of a vigorous intellectual effort; and many a master mind of the present or a former age has, from this cause, ended his days 'a driveller and a show.' A frequent indication of commencing disease in the brain is the difficulty which the individual feels in 'collecting his thoughts,' the loss of the power of combining his ideas, or impairment of memory. How many might have been saved from an early grave or the madhouse, had they taken in good time the warning of impending danger which such symptoms afford! The delicate mechanism of the brain cannot bear up long against the incessant wear and tear to which men of great intellectual powers expose it, without frequent and prolonged periods of repose. The precocious exercise of the intellect in childhood is frequently prejudicial to its acquiring vigour in manhood, for the too early employment of the brain impairs its organization, and favours the development of disease. Emotion, when suddenly or strongly excited, or unduly prolonged, is most destructive *to the proper texture of the brain, and to the operations of the mind.*"

Yet having thus explicitly stated what are the plain results of Science, these writers, alarmed by the bugbear Materialism, contradict themselves, and declare the independence of the mind. They say:—

"The nature of the connexion between the mind and nervous matter has ever been, and must continue to be, the deepest mystery in physiology; and they who study the laws of Nature, as ordinances of God, will regard it as one of those secrets of His counsels 'which angels desire to look into.' The individual experience of every thoughtful person, in addition to the inferences deducible from revealed Truth, affords convincing evidence that the mind can work apart from matter, *and** we have

* Note the logic of this "*and*"!

many proofs to show that the neglect of mental cultivation may lead to an impaired state of cerebral nutrition; or, on the other hand, that diseased action of the brain may injure or destroy the powers of the mind. These are fundamental truths of vast importance to the student of mental *pathology* as well as of physiology. It may be readily understood that mental and physical development should go hand in hand together, and mutually assist each other; but we are not, therefore, authorized to conclude that mental action results from the physical working of the brain. The strings of the harp, set in motion by a skilful performer, will produce harmonious music if they have been previously duly attuned. But if the instrument be out of order, although the player strike the same notes, and evince equal skill in the movements of his fingers, nothing but the harshest discord will ensue. As, then, sweet melody results from skilful playing on a well-tuned instrument of good construction, so a sound mind, and a brain of good development and quality, are the necessary conditions of healthy and vigorous mental action."

They here take the fact that neglect of mental cultivation may lead to an impaired state of cerebral nutrition —that idleness of mind may lead to weakness of brain —as a proof of the independence of mind and its co-operation with the brain! To show how complete a fallacy this is, we have only to consider a case precisely parallel. *Sensibility* is a property of the nervous tissue, a special property depending on the speciality of the tissue, in precisely the same sense as *Contractility* is a property of the muscular tissue. We call the collective manifestations of the one, Mind; we call some of the other, Strength. Now let the passage just quoted be brought in juxtaposition with the following:—

That Strength has an existence independent of mere blind weak Matter, will be evident to the experience of every thoughtful person. Strength, therefore, must be

accepted as an "immaterial principle," using the muscles as its instruments. Strength plays upon the muscles as a musician on the harpsichord. We have innumerable proofs that neglect of the exercise of this Strength leads to an impaired state of muscular nutrition, so that a man who does not employ his Strength will be found to have small and flaccid muscles; while on the other hand—as a further proof that Strength is independent of muscular fibre—any disease of the fibre will derange or totally destroy the powers of the muscle—as snapping the strings of a harpsichord will destroy its musical capacity! True indeed it is that physical Strength and muscular development go hand in hand, but we are *not* to conclude therefrom that Strength is dependent on the physical condition of the muscles!

Instead of such absurdity and confusion, let us calmly recognize what observation tells us, viz., that Sensibility is the special property of a special tissue, a mystery as inscrutable as that of gravitation or chemical affinity.* We shall thus escape the coarse hypotheses of Materialists and the absurd logic of Immaterialists.

* This subject is recurred to further on, p. 214.

SECTION XX.

VITAL DYNAMICS: INSTINCT AND INTELLIGENCE.

THE study of Animal Life starts, as we have seen, from the localization of the two capital properties—Contractility and Sensibility—in two fundamental tissues—the muscular and nervous. How little this fundamental position is understood by the majority of Biologists may be gathered from the fact, that while most of Bichat's successors have believed Contractility to be a property of all the tissues, differing only in degrees of intensity, even the writers of the present day are divided on the question. In the last edition of Quain's *Anatomy*, the editors modified their opinion during the progress of the work through the press; at first inclining to the belief that contractility had been observed where no muscular fibres could be traced, and only giving up that opinion in obedience to more recent and conclusive experiments. That Contractility is the special property of a special tissue is the final result of the most recent investigations. The reader is referred to Longet's *Traité de Physiologie*, and to Todd and Bowman's *Physiological Anatomy*, for ample evidence; meanwhile here is one important fact: Muscular tissue is composed of Fibrine, and Fibrine in the blood, immediately after coagulation, manifests contractility.

The Positive nature of this conception will be better appreciated by seeing how even so excellent a physiologist as Dr. Carpenter, while virtually accepting it, nevertheless wanders into the Metaphysical path, and gives a vague expression where precision was so needful. "Various attempts," he says, "have been made

to show that the contraction of Muscle is an electrical phenomenon; but no proof has been given that such is the case; and every probability seems to be in favour of its being *one of the manifestations of the Vital Force.*" What business this mysterious entity, Vital Force, has here, only a Metaphysician could imagine. The positive thinker, using the term Vital Force as the generalized expression of all the properties of organic beings, must conclude, that it is reasoning in a circle to call contractility "one of the manifestations of the Vital Force;" whereas, by calling it the special property of a special tissue, he does no more than record observed facts; and should at any future time contractility be resolved into an electrical phenomenon, the discovery will leave the speciality unaltered; since the special manifestation of electricity, known as muscular contraction, will always remain associated with a special tissue known as the muscular tissue.

It may be said, therefore, that in the perfect correspondence of the two ideas of Tissue and Property, a positive basis is given to Biology.

We are as yet but on the threshold of this science. The minute researches of thousands of inquirers are still necessary before some of the most capital problems can be solved; but the whole history of science tells us with what accelerated rapidity discoveries are made when once the right Method is thoroughly followed. Nature answers if we but know how to question. Her treasures are open if we know where to look.

Motion and Sensation are the two capital functions of Animal Life. We have only to consider either of them a moment to be aware of the immensity of work still to be done before these processes are reduced to scientific law. Of Muscular actions, for example, some are notoriously *voluntary*, some *involuntary*. This broad distinction is as perceptible as the distinction between a Plant and an Animal. But as, on closer in-

spection, it is difficult to draw the lines of demarcation between plants and animals, so, also, is it to ascertain precisely *what* actions are voluntary, and what involuntary. To take a striking example: when you hurt a frog's foot, and the frog leaps away, and leaps as often as you irritate it,—does not this seem clearly a case of *voluntary* action? It is *not*, however—at least not *always*, if ever; it is no more voluntary than your winking when a hand is passed rapidly before your eyes. You must accept this paradoxical assertion; for to prove it would require an examination of the nervous system quite beyond present limits.

Not only are the voluntary actions difficult to be demarcated from the involuntary, but there arises a further complication, inasmuch as actions which, in early life, are perfectly beyond control of the will, become afterwards so completely controllable, within certain limits, as to deserve the name of voluntary. The excretory actions, for example, are, in infancy and certain diseases, wholly involuntary; yet, by the influence of habitual resolution, they become voluntary actions. On the other hand, Dr. Carpenter luminously explains what, after Hartley, he calls "secondary automatic actions," viz., those actions which were at first performed voluntarily, requiring a distinct effort of the will for each, and become, by repetition, so far independent of the will, that they are performed when the whole attention of the mind is bestowed elsewhere.

Besides those actions which are automatic or involuntary, there is a class of actions I should be disposed to further distinguish as Organic, under which would range the Instinctive. Who that has watched mothers with their children, has not been struck with the remarkable sameness of their deportment, even to their very tricks and caresses? Who has not noticed how all children play alike? They use the same muscular varieties, throw themselves into the same complicated postures,

following the same routine. These, of course, depend on the identity of Organization; and they form a proper introduction to the study of the more special actions, named *Instincts.* These instincts are also dependent on organization: they are functions of the organism. But metaphysicians, as usual, insist upon adding to the mystery of Instinct a mysterious entity, to explain it. They range all these organic actions under a general term—Instinct, and then convert that general term into an abstract entity, which fulfils in the zoological world a function analogous to that of Mind in the human world. This implanted mystery—this shadowy semi-spiritual entity—named Instinct, has long been discussed by puzzled Metaphysicians, who, denying to Animals the possession of Mind, solve all difficulties by a jugglery of words. The positive biologist sees in it a mystery indeed, and a mystery inexplicable, but not more so than any other organic phenomenon; and, true to his principle of only occupying himself with *laws,* irrespective of essential causes, he treats it as a branch of physiology—a rudimentary reason.

De Blainville gives this definition,—*L'instinct est la raison fixée; la raison est l'instinct mobile;*—or, as the author of *The Vestiges* expresses it, they are "the same faculty in the one case *definite,* and in the other *indefinite* in its range of action."

After the Instinctive Actions, we pass on to the study of the special Senses, as a preliminary to that of Intelligence; and here let me introduce Comte's criticism on one point of this investigation. "The only point in Method which can be regarded as scientifically established, is the order according to which the various kinds of sensation ought to be studied; and those notions have been furnished by comparative anatomy rather than by physiology. It consists in classing the senses according to their increasing speciality, beginning with the universal sense, that of *con-*

tact, and successively considering the four special senses, taste, smell, sight, hearing. This order is determined by the analysis of the animal hierarchy, since those senses must be held to be more special, and more elevated, in proportion as they appear in the ascending scale. It is remarkable that this gradation corresponds exactly with the importance of each sense, if not in respect of intelligence, at any rate in respect of sociability. One must note, moreover, the luminous distinction of Gall between the passive and active states of each special sense. And an analogous consideration leads me to distinguish the senses themselves into active and passive, according as their action is essentially voluntary or involuntary. This distinction seems to me very marked between the senses of sight and hearing; the latter operating without our participation, and even in spite of it; the former requiring, to a certain degree, our participation. It seems to me that the more profound though more vague influence exercised over us by music, compared with painting, arises, in a great measure, from this diversity."

From the Senses we pass to Intelligence, or the "positive study of the cerebral functions intellectual and moral." And here I feel that Positive Philosophy demands a modification of Comte's Classification, and instead of considering Psychology as a mere branch of Physiology, we ought to insert between Biology and Sociology another fundamental science, Psychology. I am glad to be able to cite John Mill on this point, as a balance against the authoritative weight of Auguste Comte. After alluding to Comte's objections to Mind as the object of observation, he says:—

"But, after all has been said which can be said, it remains incontestable by M. Comte and by all others, that there do exist uniformities of succession among states of mind, and that these can be ascertained by observation and experiment. Moreover, even if it were

rendered far more certain than I believe it as yet to be, that every mental state has a nervous state for its immediate antecedent and proximate cause, yet every one must admit that we are wholly ignorant of the characteristics of these nervous states; we know not, nor can hope to know, in what respect one of them differs from another; and our only mode of studying their successions or coexistences must be by observing the successions and co-existences of the mental states of which they are supposed to be the generators or causes. The successions, therefore, which obtain among mental phenomena, do not admit of being deduced from the physiological laws of our nervous organization; and all real knowledge of them must continue, for a long time at least if not for ever, to be sought in the direct study, by observation and experiment, of the mental successions themselves. Since, therefore, the order of our mental phenomena must be studied in those phenomena, and not inferred from the laws of any phenomena more general, there is a distinct and separate Science of Mind. The relations, indeed, of that science to the Science of Physiology must never be overlooked or undervalued. It must by no means be forgotten that the laws of mind may be derivative laws resulting from laws of animal life, and that their truth, therefore, may ultimately depend upon physical conditions; and the influence of physiological states or physiological changes in altering or counteracting the mental successions, is one of the most important departments of psychological study."

I think, however, that Comte is better met on his own ground; and if any one will turn to the section on Organic Chemistry, and consider the arguments which force a repudiation of the encroachment of Chemistry into the proper domain of Biology, he will see how irresistibly they apply to this encroachment of Biology into Psychology. The analogy seems complete.

Biology is separated from Chemistry, not because

there is any essential distinction between organic and inorganic matter, but because there is so wide a distinction between the *phenomena;* in like manner, we must separate Mind from Life, not because there is any *essential* (noumenal) separation—(the former is but the outgrowth of the latter)—but because the phenomena of Thought are *special;* they are not the same as the phenomena of Life. Organic matter is a higher degree of complexity of inorganic matter—which special degree causes a speciality in its phenomena. So Thought is but a higher degree of Life, its speciality creating special phenomena. Comte proposes this test whereby the chemist may distinguish whether a problem truly belongs to his domain :—Can the problem be solved by the application of chemical principles alone, without the aid of any consideration of physiological action whatever? I put the same test to the Biologist, who certainly will not pretend to solve many psychical problems upon physiological principles. If the Organic world is to be separated from the Inorganic, then on the same grounds we must separate the Psychial from the Physiological.

It is proposed, therefore, to keep the Physical Sciences as Comte arranges them; and to introduce a new fundamental science—Psychology—as the basis of Sociology; that is to say, to begin the Science of Humanity with a preliminary Science of Human Nature.

SECTION XXI.

PSYCHOLOGY: A NEW CEREBRAL THEORY.

It will be necessary in this section to set aside the *Cours de Philosophie Positive* for Comte's latest work, *Politique Positive,* in which he propounds a new cerebral theory, as an improvement on that propounded by Gall. Before doing so, however, a few general remarks may be permitted with reference to the object and methods of psychological research.

Comparative anatomy is quite a modern Science, and yet, in spite of its infancy, all philosophers are sensible of its eminent importance in the construction of a true science of Biology. A necessary consequence of this study of comparative anatomy with a view to Biology, will be the study of Comparative Psychology, with a view to the clearer appreciation of our psychial condition; but as yet this new inquiry has only been pursued in a fitful and, so to speak, unconscious mood, owing mainly to the ancient prejudice against recognising anything like intelligence in the brute creation. "Brutes have instinct—men have mind:" that is the current doctrine; which, deeply considered, is about as true as to say, brutes have four legs—men have legs *and arms.* For the arm is not more demonstrably the homologue of the leg, more varied in its function owing to the varied modification of its construction, than Intelligence is an advance upon Instinct, owing to the greater development of its organ. Comparative anatomy shows us that all the innumerable varieties of vertebrate structure are but modifications of one type; and comparative Psychology will show that all the innumerable mental varieties are owing to various modifications of the

nervous system. Instinct is not essentially different from Mind; it is only the simpler function of a simpler organ. The earlier forms of mental manifestation are named Instinct; the more complicated forms, Intelligence; but as the nervous system is specifically nervous, whatever may be the amount of concentration in its central masses, so Mind is specifically Mind whatever the intensity or variety of its manifestations. Man shares with the Brute a twofold life—vegetative and animal: he also shares with the brute a twofold mental life—instinctive and rational. In ascending the scale of creation, we see *animal* life gradually encroaching on the supremacy of *vegetative* life; and in like manner we see *reason* gaining predominance over *instinct*.

The necessity of making Physiology the basis of Psychology is gradually becoming recognised, even among Metaphysicians.* How, indeed, can we ignore the relation of function and organ? How can we fail to perceive that the problem is twofold—Given the function to determine the organ, and *vice versâ?* Even Metaphysicians with their "Ego," "Soul," "Immaterial Spirit," or by whatever name they may designate it, do establish an organ for the function; but, as usual with them, they prefer a vague unknown, unknowable "something," to the plain palpable anatomical structure! So strong is this tendency, that even when positive science has demonstrated the anatomical organs, when it has shown the dependence of the functions on the nervous system, Metaphysicians still insist upon their "Spirit," and declare that it uses the anatomical organs as its "instruments," acting through them but independent of them. If, however, the physiologist were to declare that the Digestive Ego acts through the organs of Digestion, playing on them as a musician plays on a harpsichord —the Muscular Ego through the Muscular System —the Secretive Ego through the Glandular System,

* See for example, Morell's *Elements of Psychology*.

each Ego preserving its spiritual independence, we should not warmly applaud his reasoning.

It may perhaps be said: "Digestion, Muscular Action, Secretion, Thought itself, are but the modes of activity of the one Spirit located in the body, the individual Soul, the Life, mysterious yet indisputable, which rules over the organism."

The reply is simple: *What* that Life is we know not—cannot know. The mystery is impenetrable. No positive philosopher attempts to penetrate it; he objects, however, to your calling it a Spirit, *as if you knew!*—he objects to your troubling the already difficult course of investigation into the laws of psychological phenomena, by assumptions and dogmas relative to that Spirit, *as if you knew!* His province is to determine function and organ, that he may attain positive knowledge; to do so he must pursue the same course as that which has successfully led him to positive knowledge in other departments. Confining himself to such rigorous procedure, he finds the phenomena of Digestion manifested *only* by a peculiar anatomical system, varying with the varying structure; he finds the phenomena of Secretion likewise manifested by a peculiar system; and finally he finds the phenomena of Sensation and Thought manifested by a peculiar system, varying with its structural complexity; he concludes, therefore, that the phenomena *depend* on—are properties of—the nervous structure.

What is here said of Metaphysicians applies to the Materialists also, for they are equally metaphysical in their explanations of "nervous fluid," "irritability," or "vibrations." No amount of ingenuity will make an "impression" transmitted along a nerve, either by mechanical "vibrations" or by fluids of the most mysterious quality, explain the nature of *perception*, which remains the essential fact and eternal mystery.

Positive Philosophy recognises but one object of inquiry—that of *laws*; and but two modes of investigating—1st. to determine what are the specific pheno-

mena of psychological action; 2nd. what are the organic conditions on which those phenomena depend. In other words, functions and organs.

The old psychology, by the predominance it gave to Intelligence, was led to deny intelligence to Animals, and naturally admitted the plausible paradox which reduced all our emotive actions to a principle of Selfishness (in spite of the energetic denial that paradox received from every man's consciousness), as if man had no spontaneity of action, but was always intellectually *calculating* results! That Animals were Machines and that Men were Egotists, became logical deductions!

Positive Philosophy, taking its stand on actual observation, sweeps away this and many other cobwebs, and if not in a condition, as yet, to elaborate a science of Psychology, it clears the way for one, by pointing out the direction which investigation must take.

Let us now turn to Comte's cerebral theory. Before presenting the outline of his theory he expounds the Method by which alone such a system can be successfully elaborated, and indicates its points of divergence from that of Gall, whom he nevertheless regards not only as the initiator of the true physiology of the brain, but also the one who demonstrated the seats of its main functions. He insists on the importance of here giving priority to the *subjective* Method, *i. e.*, the study of mental phenomena or functions, their order of genesis and mutual relations. The correct analysis of these, however, and still more their synthesis into harmonious unity, presupposes a high condition of moral as well as intellectual advancement, and hence Comte holds the necessity of a true sociological doctrine to be an essential condition in the elaboration of a complete cerebral theory; and this condition Gall overlooked. The results thus attained are to be continually checked by that branch of the *objective* Method which was admirably applied by Gall, namely, the study of animal psychology. All our elementary faculties being held in common with animals,

animals furnish us with a test for our analysis, and especially serve to correct any undue multiplication of primitive tendencies.

The formula by which he describes his general principle is this: "Sociological inspiration controlled by Zoological appreciation."

He thus rejects the empirical Method by which Gall attained his chief results, and builds up *à priori*, i. e. by the consideration of the mental functions, their order of development and relative dignity—a system the final confirmation of which he refers to the anatomist. But in rejecting Gall's Method, he declares that Gall's discoveries have supplied him with a basis and point of departure.

Agir par affection, et sentir pour agir: such is the motto of his system, which indicates the predominance given to the emotive over the merely intellectual—in opposition to the old psychology which always subordinated the emotions to the intellect.

This emotional life (*vie affective*) is divisible into Personality and Sociality. The lower animals only manifest the first; the second commences with a separation of the sexes, and grows more and more energetic in proportion to the rank of the animal in the hierarchical scale; so that all the higher animals exhibit both Personality and Sociality. These may be denominated *Egoism* and *Altruism*.

A just equilibrium of the two sentiments is not possible. Personality usually predominates, even in man; this preponderance is in fact essential to the development of each individual existence, and arises from the instinct of self-preservation; but is modified by the opposite sentiment, in proportion as each learns to live for others. Hence results the great social problem: the subjection, as far as possible, of Personality to Sociality, by referring everything to Humanity as a whole. The social state tends towards this result, developing the weaker,

and restraining the more energetic instinct. This permanent conflict between Personality and Sociality is therefore to be regarded as the natural basis of a true general theory of Emotional life.

This being the first step in the positive classification of the different elementary tendencies, it is next necessary to separate first Personality, then Sociality, into really fundamental instincts, and to arrange them successively in a scale, of which the two extremes are represented by Egotism and Altruism.

The situation of the organs assembled under these two classes of sentiment has been, in the main, correctly indicated by Gall. Having admitted that the cerebral functions progress in dignity and diminish in energy in proportion as they advance from the back to the front, we are led to place the social sentiments in the anterior portion of the emotional region,—the less noble instincts lying behind them. We are confirmed in this arrangement by the necessity of seeking the benevolent instincts in juxtaposition with the intellectual faculties. There is an especial and intimate connection between these two classes of superior attributes. Altruism, when energetic, is always found to exercise greater influence upon the intelligence than egotism, presenting a larger field for exertion, a more difficult aim, and also a more vigorous demand for its co-operation.

Between purely Personal Interest and the Social Sentiment, there is a third more indirect interest, relating to our connexion with others, with reference to the personal advantages derivable from them. This intermediate group ought to be placed at the top of the lower portion of the brain, as, in classification, it naturally finds itself between complete Egotism, and pure Altruism.

The direct interest which constitutes fundamental egotism is separable into the instincts of Preservation and Perfectibility; the first, of course, the most ener-

getic, universal, and indispensable, although the less noble. But we cannot look upon this as a perfectly simple instinct, for it becomes necessary to distinguish the preservation of the individual from the preservation of the species. Comte has given the first of these tendencies the title of *nutritive*, from its principal attribute; but it must not be forgotten that there are other attributes, comprehending all that appertains to the material preservation of the individual. This is the most universal of all instincts, the existence of every animal depending on it, and it is therefore preponderant, even in man.

Gall assigns no special locality to this faculty, probably because of its universal importance, which, according to ancient physiological prejudices, would be incompatible with a fixed seat. But this could only be the case with animals the very lowest in the scale, and of such extreme structural simplicity as to present no anatomical distinction whatever. In every other instance, this special organ must exist, and must necessarily increase in importance as the animal rises higher in the scale of development, acquiring new and varied inclinations, whose impulses might overpower the instinct of preservation, had it not a distinct faculty. In accordance with the preceding principles, it should be sought at the brain, closely adjoining the seat of motive power and of vegetative life. Comte places it in the centre of the cerebellum,—the remaining portion of which is the seat of the reproductive instinct, imagined by Gall to occupy the whole.

Two separate instincts combine for the preservation of the species,—the one sexual, the other maternal. The former is more energetic and less elevated than the latter; and in descending the animal scale, we sometimes find the maternal instinct altogether wanting, even in cases where complete separation of the sexes exists.

Such is the arrangement of the three first divisions of

the emotional series, comprehending the three preservative instincts,—the *nutritive*, the *sexual*, and the *maternal*. The decrease of energy, in proportion to the elevation, is very remarkable here,—and a corresponding gradation is observable in the position of their respective organs,—in the centre of the cerebellum, its sides, and the base of the inferior portion of the cerebrum. Continuity of action, a quality attributable generally to the whole of the emotional faculties, is principally apparent in the first or nutritive instinct; but its occasional suspension in the other two is usually referable to peculiar circumstances which may check or divert their natural impulses.

Next to the group of the faculties of Preservation, we find a combination of the two instincts of Perfectibility which are designated by the titles of *military* and *industrial*. More dignified and less energetic than the preceding, they still approximate to fundamental egotism, influencing the individual by motives of purely personal interest. They act by opposite, yet constantly coexistent methods, the destruction of obstacles, and the creation of aids, the former the most energetic, easy, and universal. The industrial instinct appears at first sight to belong almost exclusively to man, but we recognise it in all those animals which possess the faculty of construction, often called into exercise by the preservative instincts, especially the maternal. According to our theory, the seat of both these faculties must be the back of the head, and the military instinct should be placed on either side of the organ of maternity, and the industrial immediately above that faculty.

The five egotistical tendencies thus classified, it becomes easy to extend the emotional series to those intermediate instincts which gradually approximate to the social end of the scale. This transition is accomplished by two faculties of totally distinct nature, though often confounded: *pride*, or love of power, and *vanity*, or love

of approbation. Originally personal instincts, they become social by the modification of external circumstances, in the process of satisfying their impulses. Vanity, as Gall has recognized, approximates more to sociality than pride. Each aspires towards personal ascendancy, the one by force, the other by opinion. Pride would command; vanity would persuade or convince.

There can be no difficulty in determining the position of these organs. Pride, as the more personal, is situated lowest, on either side of the industrial faculty; and vanity, as the more social, immediately above, thus terminating, as it began, the region of intermediate sentiments by a cerebral organ. Thus is the series of the seven personal instincts, common to all the superior animals, complete.

This arrangement gradually prepares the way for the noble termination of the emotional series by the group of social or *altruistic* instincts. Here we find the relative increase of dignity and decrease of energy strongly marked. The inferior energy is in some measure compensated by the greater facility of action, as individuals do not interfere with each other in the simultaneous exertion of these faculties, but benefit by participation. These nobler instincts are not confined to man; indeed, they may be studied with peculiar advantage in animals,—free from the modifications of social and mental influences.

In every complex existence, the general harmony depends upon the preponderance of some chief impulse, to which all the others must be subordinate. This preponderating influence must be either egotistic or altruistic. It is not only in a social point of view that the superiority of the latter sentiment is felt; it influences no less strongly the moral condition of the individual. A character governed by the inferior instincts alone, can have neither stability nor fixed purposes; these qualities are alone attained under the empire of the im-

pulses which prompt man to live for others. Every individual, man or animal, accustomed to live for self alone, is condemned to a miserable alternation of ignoble torpor or feverish activity. Even personal happiness and merit therefore depend on the predominance of the sympathetic instincts. Progress towards such a moral condition should be the object of every living being. *To live for others* is thus the natural conclusion of all Positive Morality.

It is reserved for Man alone to carry out this system to its highest development; but the inferior races partake in its advantages, according to their capabilities; exchanging savage independence for voluntary submission. The extension of this benefit to all classes of created beings capable of improvement is one of the most important results of our own moral regeneration. But such extension presupposes the same instincts as those which, under more favourable circumstances, elevate humanity; and such noble instincts are resident in all animals capable of being tamed by man.

The nobler instincts are few in number. Gall has classified them as Attachment, Veneration, and the supreme instinct Benevolence. The sympathetic affections must be distinguished as special or general. In the first case, they are more intense but less elevated. The faculty of *attachment*, circumscribed in its objects, unites two beings only, and is developed in animals as strongly as in man. The other special sympathy, *Veneration*, though also determinate in its objects, has a more extended scope. An important element in it is voluntary submission. This also is found in animals, but not so universally as the preceding instinct. This grand sentiment constitutes a link between individual affection and *universal benevolence*. The last mentioned faculty,—the extreme limit of the emotional series, varies, not in character but in application and degree,—extending from the vast sentiment of patriotism to individual sym-

pathy. Animals undoubtedly possess it, but in an inferior degree.

In terminating this arrangement of the emotional series, Comte points out its vast moral importance. The gradation of the social sentiments ought to be fully understood, that educational discipline may be founded on the sympathetic tendencies, of which the supreme sentiment must be regarded as the final limit, and ought only to be approached by these successive stages.

The situation of the three nobler instincts has been correctly indicated by Gall, with the exception of the first, or faculty of Attachment, which, from defect of system, he has located with the egotistical organs, and apart from the two other sympathetic instincts. Benevolence is situated at the centre, at the highest point of the cerebrum, and Veneration immediately behind it. Between these organs and that of the highest *personal* instinct there is a space, to be hereafter filled by one of the active functions. Attachment is situated on either side of Veneration, and at its base communicates with the organ of Vanity,—maintaining thus the continuity of the emotional region. The superiority justly attributed by Gall to central organs marks the importance of this social region, comprehending two single and one double organ, while the region of the personal instincts contains four double to three single. The highest point of the emotional region, so closely allied to the speculative faculties, has less connexion than the rest with the seat of motion and of vegetative life. The continuity of action, attributed to the emotional instincts, extends, in degree, to the social series.

The principal value of this arrangement is in assisting us to classify different natures and dispositions. This was seen and attempted by Gall, but unsuccessfully, owing to the philosophical defect in his method of enquiry. Comte introduces it here, because the principle should be first applied to the emotional faculties, as the

distinguishing type of character must mainly depend on the more energetic and habitual impulses, and can be only *modifiable* by the intellectual influences. Gall errs in not perceiving the radical identity of man and animals, the difference between them being only direction and degree.

In considering the ten elementary instincts which form the great emotional series,—five purely personal, three purely social, and two intermediate, partaking of both natures, ordinary observation at once leads us to a natural classification of the different types of each race, according to the nature of the predominating instinct. Dispositions influenced by the purely egotistic impulses, we call popularly "bad," and apply the term "good" to those in which altruism predominates. But the number of these *extreme* types of either tendency is comparatively small; the majority of characters in all races are alternately governed by either class of sentiment, and oscillate between the two. We must distinguish a third type, swayed principally by the two intermediate instincts, forming, in the social races, the class from whence the governing spirits are taken, and acting by command or by persuasion, according as the more personal or social of the two faculties predominates. Although it is the constitution of the emotional region which principally determines the type of a character, its *development* depends greatly on the influences exerted by the intellectual and other faculties. The original disposition remains, however, always discoverable on careful investigation, in animals as in man.

We must now proceed to the analysis of the speculative faculties, which suggest the means of satisfying the emotional impulses, and then the active faculties, which preside over the execution of the projects thus formed.

Comte differs so essentially from the doctrines of Gall respecting the intellectual faculties, that it is necessary to preface this division of the subject with a statement of their principal points of variance. The logical deficiencies of

Gall's method of enquiry have been the source of less error in treating of the emotional faculties, because they were checked by common sense and observation, and by the study of animals, where the simple instincts are to be found less modified by mental or social influences. He had also sufficient speculative boldness to disregard the metaphysical ambiguities with which preceding philosophers had concealed the truth, and having escaped this, the chief danger, instinctive sense and observation taught him to regard the *heart* as the chief source and ruler of moral life.

In treating of the intellectual functions his errors became more serious, unchecked by the two sources of correct influence he had hitherto enjoyed, (popular opinion, and the study of animal natures). Extensive generalization, founded on the positive laws of development, is necessary to the appreciation of the progress of the intellectual functions. Gall, in avoiding the errors of faulty generalizations, and unable to replace them by a sounder theory, lost himself in particular and sometimes frivolous distinctions. Detecting the fallacy of the doctrines then current upon the supremacy of the external senses, he fell into the opposite error of underrating their importance, and assigned to certain cerebral organs the principal attributes of sight and hearing.

In Gall's attack upon the doctrines of the Psychologists and Ideologists, there is nothing satisfactorily determined except in his negative discussion, where he has clearly demonstrated the fallacy of their logical explanations, analyzing the different faculties of will, memory, attention, &c., defined by his opponents as elementary attributes. But he is not so successful in the theory he attempts to substitute for these learned puerilities, respecting these general phenomena as so many modes of action, common to all the true cerebral functions, even the emotional. The small success this theory has met with is in itself an argument against it, at

a time when freedom of thought prevails, and failure is not a necessary consequence of departure from old routine. Sociology alone has enabled Comte to replace it, without returning to previous errors. Before stating his own doctrine of the elementary functions of the intellect, Comte explains his analysis of those general conditions, which proceed, as he believes, neither from original faculties nor from common modes of action, but from the concurrence of the different mental operations.

In the first place, they are limited to the intellectual organs; it was a mistake of Gall to extend their influence to the emotional series. It is impossible to grant to the emotional series the attributes of memory, judgment, and imagination; nor can they, notwithstanding their extreme sensitiveness, be said to possess *sensation*, properly so called. Popular opinion has justly applied to instincts the epithet of "blind." To feel, and to desire, are their exclusive functions. These simple motions result in impulses, but unguided by reflection or judgment, or power of self consciousness, which depends on the exertion of the intellectual organs. Incapable of reflection or judgment, the emotional organs cannot be susceptible of either memory or imagination, and any apparent exertion of those attributes is caused in reality by their reaction upon the intellectual faculties. One of the ancient intellectual attributes alone has been justly assigned by Gall to the emotional region, namely,—Will, which may even be considered to belong exclusively to it. For *Will*, properly so called, *is the final state of desire*, when mental deliberation has decided on the propriety of some predominant impulse. It is true the intellectual organs inspire special desires relative to their peculiar functions, but they are deficient in the energy necessary to induce *action, which depends solely on the emotional impulse.*

Memory and imagination, then, equally with know-

ing and judgment, are purely intellectual attributes: but they are no more peculiar functions than they are universal functions. They are to be considered solely as different compound conditions, resulting from the concurrence of the true elementary functions of the mind, hereafter to be described.

Nothing can be more erroneous than the theory formerly current of the complete separation between observation and reasoning. The operations of the mind are but a prolongation of external impressions, which again are reacted on by the former. Each act of reasoning requires a combination of these two processes. This is proved by the fact that the clearness of any conception depends upon the sufficiency and reiteration of external impressions. When these are vague and insufficient, the mind attempts to supply their place by its own combinations, and if the impulses to decision are sufficiently energetic, the intellect, unable to preserve a condition of pure suspense, decides upon deficient evidence. This state, in which the intellect instead of being merely the minister of the heart, becomes its slave, is common among animals, and is observable even in man; indeed, such may be said to have been his normal state during his long theological infancy.

Maintaining the habitual participation of the judgment in the operations hitherto attributed to sensation alone, Comte is far from attributing the same influence to memory or imagination. It is impossible to regard them as simple faculties, either peculiar or universal; each act of memory often demanding as much mental elaboration as an external discovery. The immediate and spontaneous reproduction of every impression, which constitutes a law of animal life, is quite different from memory, properly so called, which always involves a mental operation. This must be even more varied and complex in the combinations of the imagination. The celebrated argument of Gall upon individual memories

is more specious than solid. A deeper philosophical analysis would show that these apparent distinctions result from diversities of situation and training, combined with the organic difference of individual energy in the various functions. The one faculty especial to memory and imagination, is that of language.

Intellectual faculties are of two kinds, appertaining respectively to *conception* and *expression*. Though the latter, in the normal condition, are always subordinate to the former,—their separate existence, demanding an especial organ,—is thus demonstrable.

Expression presupposes conception, to which it is itself no less a necessary complement, for the purposes of social intercourse, and also as a means and a test of advance and improvement. In all the Western dialects, the word expressive of *reasoning* signifies, in its Greek etymology, *language*. On the other hand, the Italian applies the word "*ragionare*" to simple recital. But such intimate connection must not lead to the error of confounding functions so essentially distinct. In infancy language is developed before judgment,—simple formulas are acquired which are not understood till later. And in after life, the unequal rapidity of these two operations is often felt. In composition Comte says he has constantly remarked that expression precedes conception for a few sentences, and is meanwhile directed by a sort of *prevision* of their eventual harmony.* Even if we limit this discrepancy to acquired knowledge only, the case is the same, as learning and inventing necessitate the same mental operations in different degrees. Gall was therefore right in assigning to language an especial organ in man, and also in all animals above that point in the zoological scale marked by the separation of the sexes.

* "On commence toujours par parler des choses; on finit quelquefois par les apprendre. C'est que les mieux doués commencent par diviner ce qu'ils finissent ensuite par bien savoir."—Sainte Beuve.

Conception, in this higher stage of development, is of two kinds,—distinguished as *Contemplation* and *Reflection*. By the former the mind receives, through the medium of the senses, those external impressions on which all mental operations are founded. To such images the term "ideas" is properly applied. The office of the other faculty, Reflection, is the combination of those impressions, and their application to general conduct; and its results we term "thoughts." It is an error to suppose that these faculties are restricted to man; they are equally indispensable to the existence of all the superior animals, in whom the nutritive, reproductive, and maternal instincts elicit constant proofs of a high degree of sagacity, foresight, and invention.

The organ of Contemplation is situated in the lower part of the frontal region; that of Reflection immediately above it. We are led to this arrangement by the propriety of seeking near the organs of sense the single cerebral function which is directly connected with them, and of placing next to the emotional group the intellectual organ which takes cognizance of their various impulses.

We have here traced the progressive order of the intellectual faculties; first contemplative, then reflective, and finally communicative. But to arrive at the simple and fundamental nature of these functions we must still further analyse contemplation and reflection. We shall find still prevailing the principle that energy decreases in proportion as range of action increases.

We are thus led to distinguish two kinds of contemplation; the one *synthetical*, relating to beings, and possessing a concrete character; the other *analytical*, embracing events, and consequently of a more abstract nature. The first is the source of real but individual ideas,—the second of more general, but also more artificial conceptions. This latter is peculiarly applicable to Science, while the other is more so to Art.

Concrete observation is more closely dependent on external impressions, than abstract observation, which acts more indirectly, by conceptions furnished to it by the former. The organ of abstract observation ought therefore to be in immediate connection with that of concrete observation, but further removed from the organs of external sense. It is therefore situated on the median line; while concrete contemplation occupies a double organ placed over either eye.

The Analysis of the Reflective faculty will be clear to all who have rightly appreciated the positive distinction between induction and deduction. The process of Reflection is conducted by two opposite, but equally important methods,—by stating principles, and by drawing conclusions. The tendency of the former method is towards generalization; that of the latter, towards systematization. To inductive reflection belongs the study of statical relations or resemblances; to deductive that of dynamical or successive arrangement.

According to this distinction, deductive reason, the higher and more subjective faculty, though the less direct and indispensable, ought to reside in a central organ, in the midst of the upper portion of the cerebrum, in close contact with the nobler instincts, the satisfaction of which is its constant employment. Inductive logic, on the contrary, occupies a double organ on either side, closely adjoining those faculties of observation on which it is principally exercised.

In this analysis of the cerebral region devoted to the conceptive faculties, we observe four successive mental operations; 1st. the observation of beings; 2nd. that of events; 3rd. the perception of principles; and 4th. of consequences. As to the degree in which the faculty is extended to the animal world, no unprejudiced observer can ignore the evidences of deductive reasoning, apparent in their daily existence, and indispensable to it.

The last function of the intellectual series remaining

to be considered, namely, Expression, is the necessary complement of the preceding, at least in those species in which Sociality is in any degree developed. In the lower animals, where existence is purely personal, impulses find direct and simple expression in actions; but in social life some more clear indication, previous to action, is necessary to obtain the sympathy or the assistance of others. The most simple form of expression is an imitation of the appropriate action; but as more complex relations arise, a language is formed, more or less artificial, founded originally upon natural cries or gestures, and becoming more fixed and extended as the necessity for it increases. To language we owe the preservation and increase of knowledge, and its transmission is the most valuable part of instruction.

One cerebral organ influences all the different methods of expression which constitute language. Its simplest forms are actions; but vocal sounds early become, among the superior animals, the principal medium for the formation of signs. This choice is obviously determined by the natural relation between the voice and the sense of hearing, an advantage which is not shared by imitative expression.

Both these forms of expression, though principally the growth of social relations, are yet connected with personal existence, exercising the corresponding muscles, and furnishing a means for the expansion of internal emotions. The tendency of feeling and expression to react upon one another has been always remarked; and among all the superior animals, as with us, cries and gestures are employed to soothe or excite the passions.

Expression constitutes undoubtedly an intellectual function, but is more closely allied than any other to the emotional, and even to the active functions. Its especial province being to construct a true language, or system of signs, it is necessary that this fifth function should be subordinate to the four intellectual faculties,

whose office it is to direct and control it. Where these are deficient, mere verbiage is the result, the province of language being not to originate ideas, but to translate into outward expression the mental operations of the other intellectual powers.

This completes the exposition of the intellectual faculties. Two more for the *practical* qualities, viz., *Activity* and *Firmness*, complete the series.

I cannot close this brief abstract of Comte's psychological theory without urging the reader to seek in the original work a more circumstantial statement of it. I have not interrupted the exposition with comments, but here it is right to add that this abstinence from criticism is not to be interpreted into entire assent.

PART II.

SOCIAL SCIENCE.

SECTION I.

THE THREE REIGNING DOCTRINES.

We have seen in the course of our progress through the Preliminary Sciences a gradually increasing complexity of phenomena with a corresponding increase of difficulty in their scientific co-ordination; hence we have seen the earlier sciences completely positive, freed from theological and metaphysical Methods. But at any rate, even in the sciences such as Biology and Psychology, wherein these Methods are still influential, we see a distinct recognition of their being sciences, and of their needing true scientific treatment. This is not the case with Social Science. It has to be created—it has first to get itself recognized as a possible science. Instead of philosophic endeavours employed in its amelioration, Comte finds it necessary to create a new series of initial conceptions—to lay the basis for a future superstructure. Before him no one had ever schemed a Social Science. That the phenomena of society—of men aggregated in masses—were governed by laws as absolute and rigorous as those governing cosmical phenomena, was barely suspected; and nothing had been done towards their systematic co-ordination. In the following pages a brief

analysis of his attempts in this direction will be all I shall venture on.

Comte does not flatter himself that he will be able *at once* to raise this complementary branch of positive philosophy to the level of the preliminary sciences already constituted; he wishes only to set forth the actual possibility of conceiving and cultivating Social Science in the same manner as the Positive Sciences; to define exactly the real philosophic character of such a Science, and to establish its principal basis. Before entering into the subject methodically, he shows the radical inanity of the principal attempts hitherto made, and the impotence of the various political systems which strive for the government of society.

From the nature of modern civilization ORDER and PROGRESS constitute two equally imperious conditions, the close and indissoluble combination of which must in future form the basis of every real political system. No real Order can ever be established, nor most certainly can it last, unless it be fully compatible with Progress; no great Progress can be accomplished unless it tend to the consolidation of Order. The true solution of the political problem will be one in which these two elements, far from being antagonistic, will present themselves as the *two necessarily inseparable aspects of one principle*. The Order not being inertia or mere fixity, but involving Progress as one of its constituent elements; the Progress not being mere anarchy and restlessness, but involving Order as the vital condition of stability. Society is thus conceived as an Organism, in which incessant movement accompanies constant stability of form.

The present state of the political world is still very distant from this final conciliation. During the half century in which the revolutionary crisis of modern societies has developed its true character, it is impossible to deny that an essentially retrograde spirit has constantly directed all great tentatives in favour of Order;

and on the other hand, the principal efforts made in the cause of Progress have always been governed by radically anarchical doctrines. Such is the vicious circle in which society so vainly and painfully struggles, and which can terminate only by the preponderance of a new doctrine which shall be equally *progressive* and *hierarchical;* that is to say, which shall admit Order and Progress as the two indispensable conditions of political life.

The present situation becomes intelligible only if we consider it as the continuation of the general struggle going on during the last three centuries for the gradual demolition of the ancient political system. All ideas of Order are borrowed solely from the doctrine which animated the religious and military system, considered especially in its Catholic and feudal constitution; a doctrine which, from the positive point of view, represents the *theological* state of Social Science. In the same way, all ideas of Progress are exclusively deduced from that negative philosophy, offspring of protestantism, which assumed its specific development in the last century; these ideas represent the *metaphysical* state of Social Science. The various classes of society spontaneously adopt one or other of these opposite directions, according to their interests or their instincts. Rarely does either of these antagonistic doctrines present itself in its plenitude and with primitive homogeneity. They tend more and more to assume that exclusive existence in purely speculative minds only. The monstrous alliance which, in our day, men seek to establish between these incompatible principles, characterizes in their various degrees the different political shades which now exist.

Thus we have the party of Order (Tories), and the party of Progress (Radicals); but we have also the intermediate party of Whigs, which tries to unite the two, but does not, because it alternates between two systems instead of combining them; and Whigs are not inaptly styled "Tories in opposition."

It would be useless, Comte says, to enter into a special discussion of the *theological* doctrine in order to prove the necessary insufficiency of a political system which has been unable to sustain itself before the natural progress of intelligence and society! All efforts directed to the restoration of that system, even supposing their momentary success to be possible, far from restoring society to a normal condition, could only tend *to replace it in the situation which compelled a revolutionary crisis,* by forcing it to recommence with greater violence the destruction of a system which has long ceased to be compatible with the advancing state of opinion and civilization.

The exclusively critical, and consequently purely revolutionary *metaphysical* doctrine, could alone irrevocably destroy a system which, after aiding the first development of the human mind and of society, afterwards tended, by its very nature, to perpetuate indefinitely their childhood. But by an inevitable exaggeration, revolutionary metaphysics, after fulfilling an indispensable preliminary office in the general development of human society, by the demolition of the feudal and theological system, tends in future radically to hinder the final institution of political order.

Taken as a whole, the revolutionary doctrine, by a direct and total subversion of the most fundamental political notions, represents government as the necessary enemy of society, against whom the latter must be in a continual state of suspicion and hostility, in order to leave it no real attributes beyond the mere functions of general police, without any essential participation in the supreme direction of the collective action and social development. Hence the turbulence of the revolutionary party; hence, also, the wild theories fostered by it.

If we consider the revolutionary doctrine from a more special point of view, it is evident that the *absolute right of free inquiry,* of which the dogma of unlimited liberty of conscience constitutes the fundamental principle,

especially includes its immediate consequences, liberty of the press, liberty of education, or of every other mode whatever of communication among human beings. However salutary, and even indispensable, this great principle may have been hitherto, and may be still, on various grounds, it is nevertheless impossible to doubt, on examining it from a really philosophic point of view, that not only can it in no way constitute an organic principle, but that it even directly tends more and more to become a systematic obstacle to all true social reorganisation. Whatever development may be presupposed in the mass of men, is it not evident that social Order will always of necessity remain incompatible with the permanent liberty granted to every one, of daily troubling society by discussion of its fundamental principles?

The same may be said of the dogma of *equality*, the next in importance to that of unlimited liberty, to which it stands moreover in natural relation, the most fundamental equality being that of intellect. Applied to the old system, this dogma has hitherto happily seconded the natural development of modern civilization, by presiding over the final dissolution of the old social classification. It was then a principle of progress; applied to the new order of things, it assumes an essentially anarchical character. In fact, far from bringing us nearer to a chimerical equality, the progress of civilization tends on the contrary, by its very nature, to develope extreme intellectual and moral inequality, at the same time that it much lessens the importance of the material distinctions which so long kept them in abeyance.

Applying the same reasoning to the dogma of the *sovereignty of the people*, Comte shows from this point of view the indispensable though transitory office of that revolutionary dogma as applied to the demolition of the ancient system, and at the same time demonstrates the obstacle it now constitutes to all regular institution, by condemning, he says, all superiors to an arbitrary

dependence on the multitude of inferiors, by a sort of transference of the Divine right, from "Kings" to "Peoples."

Finally, the general spirit of revolutionary metaphysics manifests itself in an analogous manner when considered in its international relations. By the political annulling of the ancient spiritual power, the fundamental principle of unlimited liberty of conscience at once determined the spontaneous dissolution of European Order, the maintenance of which formed one of the most natural functions of Papal authority. The conditions of independence and national isolation, and, consequently, of mutual non-intervention, which formed the chief features of this transitory situation, evidently constituted the necessary preparation to political regeneration, until the sufficient manifestation of the new social order should disclose under what law the various nations are to be finally re-associated. Until then, indeed, all attempts at European coordination being inevitably directed by the ancient system, would tend only to overrule the political science of the most civilized peoples, by that of the least advanced. But by consecrating this spirit of exclusive nationality in an absolute manner, revolutionary metaphysics now tend directly in the present day to prevent the recognition of social reorganisation, thus deprived of one of its principal characteristics, universality.

In order to completé this estimate of the revolutionary doctrine, it only remains to demonstrate its radical inconsistency. If, from their revolutionary purpose, perfect cohesion among the various parts of metaphysical politics may be dispensed with, it is evident that at least the ensemble of the doctrine must never become directly opposed to the very progress it should assist, nor should it tend to maintain the essential basis of the political system which it is its aim to destroy. It is easy to prove that such is, in both respects, the present condition of revolutionary metaphysics. Let us first

examine it in its highest possible state, when, during the most advanced phase of the French Revolution, and after receiving its entire systematic development, it momentarily obtained entire political preponderance. Now it is precisely when having no longer to struggle intellectually against the ancient system, that it likewise developes least equivocally its spirit radically hostile to all real social reorganization. That opposition had already manifested itself at the very time of the philosophic elaboration of that doctrine which is found throughout imbued by the strange metaphysical action of a pretended *state of nature*, the primordial and unvarying type of all social states. Can we wonder if, starting from such a principle, the revolutionary school has been led to conceive every political reform as destined to reestablish as completely as possible that supposed "primitive state?" Is not that, in reality, systematically organizing universal retrogression under pretence of eminently progressive intentions?

Ever since the fundamental aberrations induced by the momentary triumph of revolutionary metaphysics began to bring it into discredit, its characteristic inconsistency has especially manifested itself in another no less decisive form, namely,—the critical doctrine has been invariably led to proclaim the preservation of the general bases of the old political system, of which it had for ever destroyed the principal conditions of existence!

Hence we have seen Christianity (so "indispensable to Order!") assuming a new and simpler shape, and finally reduced to that vague and impotent theism which, by a monstrous perversion of terms, metaphysicians have called *natural religion*, as if all religion were not necessarily supernatural! In pretending to conduct social reorganisation in accordance with this strange conception, the metaphysical school, notwithstanding its purely revolutionary tendency, has therefore *implicitly* adhered, and often, at the present day, has done so *explicitly*, to the most fundamental principles of the old

political doctrine, that which represents social order as necessarily resting on a theological basis !* Armed with such a concession, the school of Bossuet and De Maistre will always have an incontestable logical superiority over the irrational detractors of Catholicism, who, whilst proclaiming the necessity of a religious organisation, deny to it all the elements indispensable to its social realization.

This character of general inconsistency, which, whilst destroying the ancient system, yet pretends to maintain its essential bases, is no less marked in the temporal application than in the spiritual development of revolutionary metaphysics. In the former, it manifests itself more especially by an evident tendency to the preservation, if not of the *feudal* spirit properly so called, at least of the *military* spirit which was its real origin.

This twofold examination of theological politics and of metaphysical politics will suffice clearly to characterise the necessary insufficiency of each to obtain its own special end, by showing that the latter does not in reality better fulfil the principal conditions of Progress, than the former does those of Order. It is easy to see that in spite of their radical opposition, the retrograde and the revolutionary schools tend by an irresistible necessity mutually to keep up their political life, by virtue of their reciprocal neutralization. Fearing the absolute ascendancy of either, though from different causes, society, for want of a more rational and more efficacious doctrine, employs each doctrine in turn, to withstand the encroachments of the other. This miserable, oscillating constitution of our social existence will of necessity prolong itself until a real and complete doctrine, organic and progressive, permits mankind to renounce this perilous and insufficient alternative by satisfying, directly and

* It may not be needless to caution the reader against confounding *theological* with *religious* in this passage, as throughout the work. The necessity for a religious basis in all social organization, no man has more emphatically insisted on.

simultaneously, the two essential aspects of the great political problem. Until then, the chief practical use of each being to prevent the triumph of the other, they must constitute two inseparable elements of the political movement. Lastly, it is necessary to remark that each of these opposite doctrines forms an element in our strange political situation by assisting in the general position of the social problem, represented by one under the organic, by the other under the progressive point of view.

The influence of the revolutionary philosophy in compelling social conceptions to assume a more progressive character, has become so evident, that it needs no further discussion. There is but one way of superseding it, which is, by carrying out its own objects *better* than it has itself been able to do. In any other way, all declamations against the revolutionary philosophy will fall to the ground before the invincible and instinctive attachment of society to principles which during the last three centuries have directed all its political progress, and which it justly considers as alone in the present day containing the general conditions indispensable to its ulterior development. It is in vain to deplore in the name of social order the destructive energy of the spirit of analysis and inquiry. That spirit is eminently salutary, and by its restless activity will end in producing a doctrine capable of satisfying all demands and sustaining all discussion.

Such is the vicious circle within which the human intellect is now limited with regard to social ideas, compelled as it is, in order to maintain even imperfectly the really integral position of the political problem, to employ simultaneously two incompatible doctrines which cannot lead to any real solution, and each of which, though provisionally indispensable, must be held in check by the antagonism of the other!

A third and essentially stationary opinion, the

organ of these oscillations, and formed out of the remains of both, has gradually sprung up between the retrograde and the revolutionary doctrines. The *stationary* school professes to maintain the principles of the old system, whilst radically obstructing its conditions of existence. In the same way, after giving a solemn adhesion to those principles of the revolutionary philosophy which constitute its sole logical force against the retrograde doctrine, it prevents their development, by suggesting far-fetched obstacles to their daily application. In a word, this policy, so proudly disdainful of utopias, proposes the most chimerical of utopias, seeking to fix society in a contradictory situation between retrogression and regeneration, by an antagonism of the instinct of Order with that of Progress. Such a theory is useful as a provisional organ for lessening the danger of the preponderance of one or other philosophy, and helps to prepare the final social regeneration. But it is clear that the final reorganization of modern society can be in no way guided by such a theory; a theory which in its temporary utility has but the purely negative and imperfectly fulfilled object of preventing kings from retrogression, and peoples from revolutions!

SECTION II.

ATTEMPTS TO CREATE A DOCTRINE.

THE foregoing analysis of the systems which at present rule political discussions, has demonstrated their inability to direct social reorganization. It now only remains for us to point out the principal social dangers which result from the prolongation of such an intellectual condition, and which, from their very nature, grow worse day by day.

The most universal consequence of this situation, its most direct and most hurtful result, the first source of all other disorders, consists in the increasing extension of intellectual anarchy. The evil has already gone so far that all political opinions, although uniformly drawn from the triple general basis indicated in the last section, take an individual character, owing to the innumerable shades of opinion possible through the mixture of the three systems. It grows more and more impossible to make even a few adhere to an explicit profession of political faith, except in the vagueness and ambiguity of an artificial language which seeks to produce the appearance of a co-operation which cannot exist. Such is the eminently complex nature of social questions, that even without any sophistical intentions the *pro* or *con.* may be pleaded in an extremely plausible manner upon almost all points. In the melancholy daily course of our political struggles, the most honest men are naturally led to tax one another with folly or depravity, on account of the opposition of their social principles. On the other hand, on every

grave occurrence, the most opposite political maxims are habitually maintained by partisans equally worthy of admiration. How could the continual influence of a spectacle so essentially incompatible with any profound conviction, leave any real political morality either among those who participate in it, or those who witness it? Its dissolving action makes itself felt with increasing intensity, in questions of domestic, and even personal morality, that necessary foundation of all others. It is clear that the elements of all sociability are compromised by discussions which, not being subjected to real and universally recognised principles, only tend to perplex and discredit the ordinary ideas of morality, by bringing them into question when no solution is practicable.

As a necessary consequence of such disorder follows the second characteristic of our situation, "systematic corruption organized into an indispensable means of government." Not only does intellectual disorder permit the development of political corruption, the all extensive practice of which would be impossible if there were sincere and universal convictions, but necessarily compels it as the sole practicable means of determining a certain effective convergence, which social Order cannot completely do without. So that, by an evident harmony, corruption on a large scale will cease to be possible, as soon as society is able to bear better discipline. Until then, one may reckon on the inevitable increase of that wretched expedient, as is testified by all people who have long been under what is now called the "constitutional," or representative system, and have thus been forced to organise a certain material discipline out of profound intellectual and consequently moral disorder.

The third essential symptom of our social situation consists in the increasing preponderance of the material and temporary view taken of political questions.

After confessing that the fundamental crisis of actual society proceeds from intellectual anarchy, it is impossible too strongly to deplore that irrational unanimity of the political world, which, by proscribing speculative researches, directly tends to interdict the only issue out of such a situation!

This summary examination of the chief features of our social situation has confirmed our analysis of its various constituent elements; the effects have shown themselves in perfect harmony with the causes. Theological and metaphysical theology having hitherto undertaken to bring about the political reorganisation of modern society, and shown their incompetence, it evidently follows, either that the problem is not really capable of solution (which would be absurd), or that nothing remains but recourse to Positive Philosophy, since the human mind has vainly exhausted in fruitless endeavours all other intellectual methods. It has been proved that in its gradual evolution, more especially during the last three centuries, this Positive Philosophy has successively brought about the total reorganization of various anterior conceptions, to the unanimous satisfaction of the intellectual world. Now, how should a philosophy which is certainly neither anarchical nor retrograde with regard to astronomical, physical, chemical, and even biological notions, become so with regard to social ideas alone? Why should this last category of ideas be excepted from an application which has gradually embraced less complicated categories, including that which resembles it most? The Positive Philosophy, properly completed, is therefore alone able to preside over the final reorganization of modern society.

It has been demonstrated that the radical deficiency of actual society is in its nature eminently theoretical, and that consequently intellectual and moral reorganization must necessarily precede and direct political reorganization. Nevertheless, before proceeding to this

philosophical operation, it is needful to consider the principal philosophical efforts hitherto made to form social science; of which a general appreciation must tend to characterise the nature and spirit of this last branch of positive philosophy.

The human mind has hitherto been unable to found social science on a really positive basis. In other sciences, in consequence of the immutable perpetuity of phenomena, rational observations were only difficult from the deficiency of well-trained observers. But by an exception belonging to social science alone, and which must have specially tended to prolong its infancy, it is clear that the phenomena themselves long wanted the fulness and variety of development indispensable to their scientific examination, irrespectively of the conditions to be fulfilled by the observers. The conditions relative to the very succession of the phenomena, allow us, with no great uncertainty, to fix the present century as the necessary epoch for the definitive formation of social sciences, hitherto essentially impossible. Until now, indeed, the fundamental tendencies of man could never be sufficiently marked to become the subject of scientific valuation. All idea of social progress was naturally impossible to the philosophers of antiquity, for want of sufficiently complete and mature political observations. Thus, not even the most eminent and judicious among them was able to resist the universal tendency to consider the contemporary social state as radically inferior to that of anterior periods.

Montesquieu, by his *Esprit des Lois*, is the first philosopher who can justly be said to have laid any basis for social science. That which characterizes the chief force of this memorable work, and shows the superiority of its illustrious author over all contemporary philosophers, is the preponderating tendency to conceive political phenomena as necessarily controlled by invariably natural laws.

At a period when the greatest minds, occupied with

vain metaphysical utopias, still believed in the absolute and indefinite power of legislators, armed with sufficient authority, to modify the social condition, how much before his age must a man have been who dared to conceive the various political phenomena as, on the contrary, always ruled by natural laws, the exact knowledge of which must serve as a rational basis to any wise social speculation in guiding the practical combinations of statesmen!

Unfortunately the very causes which settle so distinctly Montesquieu's unquestionable political pre-eminence over all his contemporaries, also prove the impossibility of any real success in an undertaking so premature in its principal object, and of which most essential preliminary conditions, whether scientific or political, were then far from sufficient realization.

Since Montesquieu, the only important step towards the fundamental conception of Sociology is due to the illustrious and unfortunate Condorcet, in his memorable work *L'Esquisse d'un tableau historique des progrès de l'esprit humain.* Here, although the great philosophical scheme planned by Montesquieu may in reality have been equally abortive, it nevertheless remains as an incontestable fact that for the first time the primordial scientific notion of a social progression of Humanity was clearly introduced, which was certainly not the case in Montesquieu. The general nature of the scheme was clearly indicated, although the whole undertaking still remains to be accomplished.

Comte closes this inquiry by some philosophical reflections on political economy. The economists, he says, have persuaded themselves, in good faith, that they have succeeded in submitting what they call economic science to the positive spirit; and they daily propose their method as the type according to which all social theories must be definitively regenerated.

One consideration, if it could be fully felt, would

suffice clearly to characterise the necessary inanity of the scientific pretensions of economists, who, having mostly emerged from the ranks of legists and literary men, have certainly been unable to learn that habitual spirit of positive rationality which they think they have carried into their researches.

When we leave the world of entities for real speculations we perceive how the economic and industrial analysis of society cannot be positively accomplished apart from its intellectual, moral, and political analysis. The predilection which the human mind seems to manifest in our days for what is called political economy, must be considered in reality a symptom of the want felt of at last submitting social studies to really *positive* methods.

Another indication of this tendency manifests itself by the increasing disposition towards historical studies, and the progress these have made within the last two centuries. Nevertheless, notwithstanding its progress, so happily destined to prepare its final regeneration, history has not yet lost its essentially literary descriptive character.

SECTION III.

GENERAL SPIRIT OF SOCIOLOGY.

After these general indications, intended to show the urgency and opportuneness of social science, Comte enters upon the characteristics of the positive Method in the rational study of social phenomena.

On considering the present state of social science, it is impossible not to recognize the combination of the various characters which have always distinguished the theologico-metaphysical infancy of all other branches of philosophy. This situation of political science exactly reproduces before our eyes the analogy of what Astrology was to Astronomy, Alchemy to Chemistry, and the research after the universal panacea to Medicine. The peculiarity which theological politics and metaphysical politics have in common, consists principally, as to Method, in the preponderance of imagination over observation, and as to Doctrine, in the search after absolute notions; whence results the tendency to exercise an arbitrary and indefinite action on phenomena, which are not believed to be subject to invariable laws. In a word, the general spirit of all speculations in the theologico-metaphysical state is necessarily ideal in its course, absolute in its conception, and arbitrary in its application. Now it is impossible to doubt that such are still at the present day the predominant characteristics of social speculations.

Positive philosophy follows a very different course; it is characterised by that necessary and permanent subordination of the imagination to observation which

specially constitutes the scientific spirit, in opposition to the theological or metaphysical spirit. By virtue of their superior complexity, and their more intimate connection with human passions, it was natural that political speculations should be plunged deeper and longer than any other in this deplorable philosophic situation, in which they still languish, whilst more simple and less stimulating studies have been successively freed from it during the last three centuries. As Hobbes sarcastically remarked, even the axioms of geometry would be disputed if men's passions were implicated in them.

If, instead of considering the general spirit of positive philosophy, we consider the character of scientific conceptions, it is easy to perceive that Positivism is principally distinguished from the theologico-metaphysical philosophy by a constant and irresistible tendency to render *relative* all the notions which at first were *absolute*. The relative character of scientific conceptions is inseparable from the true notion of natural laws; the chimerical tendency to absolute knowledge spontaneously accompanies the use of theological fictions or metaphysical entities. Although man's power of modifying phenomena at his own pleasure can only result from knowledge of their natural laws, it is nevertheless incontestable that the infancy of human reason necessarily coincided with the characteristic pretension of exercising an *unlimited* action upon corresponding phenomena. The history of human opinion clearly verifies this aberration with regard to stronomical, physical, chemical, and even biological phenomena. The error now only survives in social phenomena. Indeed, it is evident that notwithstanding the tendency of the public mind towards a healthier philosophy, the preponderating disposition of statesmen and even of civilians, whether of the theological or metaphysical school, still habitually consists in conceiving

social phenomena as indefinitely and arbitrarily modifiable, by continuing to suppose the human species as deficient in all spontaneous impulse, and always ready passively to endure the influence of a legislator, whether temporal or spiritual, provided he be invested with sufficient authority. It is perfectly impossible to establish any stable and general notion on politics, whilst human society is regarded as moving without free will of its own, under the arbitrary impulsion of the legislator. In the future, therefore, no order or agreement are possible in political philosophy without subjecting social phenomena to invariable natural laws; that is to say, without introducing into the study of social phenomena the same positive spirit which has already regenerated and disciplined all other branches of human speculation.

The principle of Sociology consists in conceiving social phenomena as inevitably subjected to natural laws. We must first fix the peculiar character of these laws. To obtain this result, we must extend a truly scientific distinction to social phenomena, by considering separately, but always with a view to an exact systematic co-ordination, the *static* and *dynamic* aspect of each subject of positive study. In Biology, this indispensable analysis enables us to distinguish between the purely anatomical or static point of view, relative to organization, and the physiological or dynamic point of view, directly relating to life. In Sociology, this analysis must play an analogous part, distinguishing between the study of the *conditions* whereby Sociology exists, and that of the *laws* of its *continuous movement*. This scientific dualism corresponds with the twofold connection of Order and Progress; for it is evident that the static study of the social organism must coincide with the positive theory of Order; and the dynamic study of the collective exist-

ence of Humanity must constitute the positive theory of social Progress.

Sociology thus unites the two equally fundamental ideas of Order and Progress, the radical opposition of which we have perceived to constitute the principal characteristic symptom of the profound perturbation of modern society.

Social anatomy, *Static* Sociology, has for its object the positive study, at once experimental and rational, of the mutual action and reaction which all the portions of the social system continually exercise upon each other.

Without here establishing the theory of Authority, it is evident from the very nature of the social state that all power is necessarily owing to a corresponding *assent* (either spontaneous or premeditated, explicit or implied) of the various individual wills, concurring in a general course of action, of which this power is at first the organ, and afterwards the regulator. Thus Authority results from agreement, not agreement from Authority; so that no great power could result but from strongly preponderating inclinations in the society in which it is established; and when nothing strongly preponderates, the authorities are feeble and languishing.

This consensus of social organization is the principle of static sociology. We have only to conceive the political system according to its relation, sometimes special, sometimes general, with the corresponding civilization. Positive philosophy, by indicating the spontaneous conformity of each effective political system with a corresponding civilization, also teaches that this natural Order must often be very imperfect, in consequence of the extreme complication of phenomena. Far from forbidding human intervention, such a philosophy eminently demands its wise and active applica-

tion, by directly representing social phenomena as being by their very nature at once those most easily modified, and those which most need modifying.

Although the static conception of social organization must constitute the basis of all Sociology, we must nevertheless acknowledge that not only do social *dynamics* form the part most directly interesting, especially in our day, but that they alone give to the new science its most decisive philosophical character, by clearly developing the notion which distinguishes Sociology from Biology; that is to say, the idea of continuous *progress*, or of the gradual *development of Humanity*.

For the more facile appreciation of this idea, it is necessary to establish the hypothesis of a single people, to which all the consecutive social modifications observed among distinct populations should be referred. This done, the true spirit of dynamic sociology consists in conceiving each of those consecutive social conditions as the necessary result of the one preceding it, and the indispensable impulse to the one following it, in accordance with the luminous axiom of the great Leibnitz: *The present is pregnant with the future.* The object of science is therefore to discover the constant laws which rule this continuity, and determine the march of human development. In a word, in social dynamics we study the laws of *succession*, whilst in social statics we study the laws of *co-existence;* so that the application of the former is to furnish the real theory of Progress to practical politics, whilst the latter spontaneously forms that of Order.

At all times, and in all places, the ordinary course of individual life, notwithstanding its extreme brevity, has enabled men to perceive certain notable modifications which have taken place in the social state. Now, it is the gradual but continuous accumulation of these successive changes which constitute the social move-

ment. Under whatever aspect we consider society, its successive modifications will always be found subjected to a determined order, of which the rational explanation is already possible in a sufficient number of cases for us to hope that we shall ultimately be able to detect it. This order presents moreover a remarkable fixity, which is very apparent when we compare the parallel developments observed among distinct and independent populations. It is a conception without which no real social science can exist; and it presents the most incontestable reality. No discussion is possible with those blind to it; any more than with those who reject the fundamental notions of any other science; for example, of the organic series in Biology, of which the Sociologic series constitutes the philosophic equivalent. This preliminary conception of human development must spontaneously produce the general disposition to consider the social state as having been as perfect at each epoch, as the corresponding age of humanity permitted, combined with the correlative circumstances, under the empire of which its actual evolution was accomplished.

This philosophic conception, without which history would remain radically incomprehensible, naturally becomes the complement to the one before noticed in static Sociology. One is to Progress what the other is to Order; and both necessarily result from the same evident principle, *i. e.*, from that predominance of the *relative* over the *absolute* point of view, which principally distinguishes positive philosophy. Such a philosophic consideration only tends to bring into the habitual examination of social phenomena, whether past or present, that wise scientific indulgence which disposes to the better appreciation, and even to the more easy perception, of the true historic filiation of events. By such preliminary notions, static and dynamic, the general spirit of the new political philosophy seems sufficiently characterized so as to fix the rational posi-

tion of sociological questions. Without either admiring or reprobating political *facts*, seeing in them, as in all other sciences, simple subjects for observation, Social Science considers each phenomenon from the double point of view of its harmony with co-existing phenomena, and of its connexion with anterior and posterior states of human development.

SECTION IV.

SOCIAL STATICS: METHOD AND ELEMENTS.

In Sociology, as in Biology, scientific investigation employs conjointly the three methods of the general Art of Observation: that is to say, Observation, Experiment, and Comparison. We must here therefore consider the relative position and peculiar character of these successive modes of procedure.

In every order of phenomena, even the most simple, real Observation is only possible in as far as it is primarily directed and finally interpreted by some Theory. Such a logical necessity becomes irresistible when complicated phenomena are in question; without the luminous indication of a previous theory, the observer would not know *what* he was to examine in the fact passing under his eyes. It is therefore evident that social observations, even more than all others, require the continuous use of theories destined to connect the present with the past.

Facts are not wanting; for, in this order of phenomena more than in any other, the most obvious are necessarily the most important, notwithstanding the puerile pretensions of collectors of secret anecdotes; but they remain profoundly sterile, and even unperceived, for want of the intellectual dispositions and speculative indications indispensable to their real scientific examination. Thus, examined according to rational views of solidarity or succession, social phenomena doubtless offer far more varied and extensive means of observation than the other less complicated phenomena. It

is thus that not only the immediate inspection or direct description of any events whatever, but also the consideration of apparently the most insignificant customs, the interpretation of various sorts of monuments, the analysis and comparison of languages, etc., may offer to sociology useful means of positive examination: in a word, everyone may succeed in converting into precious sociological indications the impressions received from almost all the facts of social existence.

The second art of observing, or Experiment, properly so called, is here only exercised in an indirect manner, by applying it to pathological cases, which constitute, in biological studies, the real scientific equivalent of pure Experiment, since the natural experiences they offer us are eminently appropriated to the study of the complex phenomena of organization. Here, this pathological analysis consists in the examination of cases, unfortunately too frequent, in which the social laws suffer the perturbations seen in revolutionary periods, especially in the present day.

These perturbations are, in the social organization, exactly analogous to individual diseases. In both cases, it is making a noble use of reason to apply it to the better unfolding of the real laws of our nature, by the scientific analysis of the serious disorders by which its development is accompanied. It is true that cases of social disturbance are considered unfit to unfold the laws of political organism, which are then supposed to be destroyed, or at least suspended. But these pathological cases cannot constitute any real violation. As the laws always exist in some state of the social organism, we can deduce with proper precautions, from the scientific analysis of perturbations, the positive theory of normal existence.

The third mode of observation, or Comparison, necessarily predominates in all studies of which living bodies are the subject. The chief point of this method

consists in bringing together the co-existent states of society in different parts of the globe, considered especially among those populations most independent of one another. Nothing is so proper as such a method for distinctly characterizing the various essential phases of human evolution, thenceforth susceptible of being simultaneously explored, so as to show their principal attributes in an unequivocal manner. In the first place this comparative method has the advantage of being equally applicable to the two essential orders of sociologic speculations, Static and Dynamic, so as to verify both the laws of existence and those of movement, sometimes furnishing valuable indications with regard to each.

In the second place, it extends in the present day to all possible degrees of social evolution, of which the characteristic features can thus be effectually submitted to our immediate observation: from the unfortunate inhabitants of Terra del Fuego to the most advanced people of Western Europe, it is impossible to imagine any form of social existence which is not actually realized in certain parts of the globe, and even, almost always, on several perfectly separate localities. But we must repeat, with regard to this application of the comparative method to sociology, what has been said already of Observation and Experiment, viz., the impossibility of using such a plan usefully, without constantly directing its original application and final interpretation by a rational conception of the development of Humanity.

After completing the preliminary examination of the general spirit which must characterize Sociology, and the various modes of exploration peculiar to it, we must now proceed to the elaboration of that great subject. The plan to be followed consists in examining successively the three principal orders of sociological considerations, more and more complex and special, by

taking into consideration the general conditions of social existence: first with relation to the Individual, then to the Family, and finally to Society, which, having attained its entire scientific extension, tends to embrace the totality of the human species.

As to what concerns the Individual, Gall has scientifically established the irresistible social tendency of human nature. The sociability of the human species, by virtue of an instinctive tendency to live in common, independently of all personal calculation, and often even in spite of the most energetic individual interests, cannot be contested. It is necessary to signalise the influence of our most important attributes in order to give Society the character which always belongs to it, and which its subsequent development can never alter.

For this we must first consider the energetic predominance of the emotional or affective over the intellectual faculties, which is less marked in man than in other animals. The intellectual faculties being the least energetic, their activity, if prolonged in one direction beyond a certain point, induces in most men an almost insupportable fatigue. So that by an unfortunate coincidence, in order to ameliorate his primitive situation, man needs precisely the very kind of activity for which he is least fitted. Instead of vainly deploring this discordance we must note it as a first essential fact which must have a radical influence on the general character of human societies.

There is a second character which we must take into consideration: besides the general ascendant of emotional over intellectual life, our least elevated instincts, those most specially egotistical, have an undoubted predominance over those nobler tendencies directly relative to sociology.

If it were possible to destroy the preponderance of

our personal instincts, our moral nature would be radically destroyed, not ameliorated; since the social affections, henceforth deprived of an indispensable direction, would soon tend to degenerate into a vague and useless charity, devoid of all great practical utility. When the most advanced morality prescribed to us the strict obligation of loving our neighbours as ourselves, it expressed the fundamental principle, with that degree of exaggeration which the indication of a type demands, because the reality is only too sure to fall below it!

Such are the two natural conditions of which the combination determines the character of our social existence. We must now proceed to a similar survey of the second order of elementary considerations of social statics, *i. e.* those which concern the Family.

As every system must be composed of elements homogeneous to it, scientific artifice does not allow Society to be considered as made up of individuals. The true social unity consists in the Family alone, at least reduced to the elementary Couple, which constitutes its principal basis. No society can be so intimate as that admirable primitive combination by which two natures become almost fused into one. This perfect intimacy could only be established in the Family by the energetic spontaneity of a common object, combined with the no less natural institution of an indispensable subordination.

In spite of the vague notions formed in the present day about social Equality, all society, even the most limited, presupposes not only diversities but also inequalities. For there can be no real society without permanent cooperation in one general operation, by distinct means, properly subordinate to one another. Now the most complete realization possible of those elementary conditions belongs to the Family alone.

The attacks made on this fundamental institution in the present day must be considered as the most fearful symptom of our tendency to social disorganization. But such attacks are only dangerous because of the decrepitude of the creeds on which the Family, as well as all other social notions, are still exclusively based.

In the course of social evolution, the organization of the Family progressively receives extensive modifications, the ensemble of which gives us, at each great epoch of development, the exact measure of the real importance of the social change then effected. The sociological theory of the Family may be reduced to the examination of two orders of necessary relations: first, the subordination of sex; and second, that of age; one of which institutes the Family, the other maintains it.

Doubtless the institution of marriage suffers some modifications in the gradual course of human evolution; but however radical these changes may be considered, they will be in conformity with the invariable spirit of the institution, which is here our principal object. Now this spirit always consists in a natural subordination of woman; all ages of civilization reproduce this ineffaceable character under various forms. A just biological philosophy is beginning to discredit those chimerical revolutionary declamations on the pretended equality of the two sexes, by directly demonstrating, either by anatomical investigation or physiological observation, the radical differences, both physical and moral, which, in all the animal species and the human race more especially, so distinctly demarcate them, notwithstanding the preponderance of the specific type.

After completing this scientific examination, Sociology will first prove the radical incompatibility of all social existence with that chimerical "equality of the sexes," by characterising the special and permanent functions which each must fulfil in the natural economy of the

Family. Of the two general attributes which divide Humanity from Animality,—intellect and affection,—one demonstrates the necessary and invariable preponderance of the male sex, whilst the other directly characterizes the indispensable moderating function devolving on woman independently even of maternal cares, which evidently constitute her sweetest and most important special destination. This invariable economy of the human family never can be really altered unless we suppose a transformation of our cerebral organism.

Let us now consider the other element, that is to say, the co-relation between children and parents. Nothing deserves more admiration than that happy subordination which, after constituting the Family, afterwards becomes the necessary type of all social co-ordination. It is impossible that in more extended and less intimate relations the discipline of society can ever fully realize those admirable characteristics of domestic discipline; submission can be neither so complete nor so spontaneous, protection neither so touching nor so devoted. But the life of the family will nevertheless remain, in this respect, the school of social life, whether for obedience or command, which must in in every case approach as nearly as possible to this elementary model.

To complete the sociological considerations on domestic subordination, it is needful to remark its characteristic of spontaneously establishing the first notion of social perpetuity by connecting the future with the past. Whatever degree social progress may attain, it will always be of capital importance that man should not think himself born yesterday; and that the whole of his institutions and manners should constantly tend to connect, by a proper system of intellectual and material signs, his memories of a past with his hopes of a future.

A philosophy which represents men of all times and places as being in every respect so many indispensable co-operators in a fundamental evolution, whether intellectual or material, moral or political, must certainly in the present day be considered as more suited than any other to develope the sentiment of social continuity, without incurring the danger of that servile and irrational admiration of the past, which formerly, under the empire of the theological philosophy, hindered progress.

Having thus established the fact of the Family being not only the effective element of society, but as offering in every respect the first natural type of its radical constitution, we have now to consider society as composed of families and not of individuals.

Simplicity is not the principal measure of real perfection; biological studies show, on the contrary, that the increasing perfection of the animal organism consists in the increasing speciality of the various functions accomplished by organs more and more distinct, yet nevertheless always interdependent. Now such is eminently the proper characteristic of our social organism. Is it possible to conceive anything more wonderful than that regular and continuous convergence of an immensity of individuals, each endowed with an existence distinct and to a certain degree independent, and nevertheless all ceaselessly disposed, notwithstanding the differences of their talents and characters, to concur by a multitude of various means in one general development, without having in the least concerted together, and most frequently in active unconsciousness—all fancying they are only following their personal impulses?

This invariable conciliation of the division of labour with the co-operation of efforts, becoming more decided and admirable the more complicated and extended society becomes, constitutes the fundamental characteristic of human operations, when we rise from the simply domestic, to the social point of view.

The division of labour, which constitutes the elementary principle of society, cannot be that of the family. Although an habitual co-ordination between distinct branches of labour must to a certain degree be established therein, its influence is so secondary, that when unfortunately it remains the only connecting tie, domestic union tends to degenerate into a mere association, and often becomes dissolved. In social combinations elementary economy presents an inverse character; the feeling of co-operation, until then only an accessory, becomes in its turn predominant, and the sympathetic instinct no longer forms the principal link.

Properly to judge this co-operation and division of labour as constituting the essential condition of our social existence, domestic life alone excepted, it must be conceived in its philosophical extent; that is to say, applying it to all our various operations, instead of confining it to simple material habits. It then leads us to regard, not only individuals and classes, but also different peoples, as participating in an immense common labour, of which the gradual development connects the actual operators with their predecessors, as well as with their successors.

It is, therefore, division of the various occupations which principally constitutes social solidarity, causing the increasing complication of the social organism, which is then conceived as embracing the whole of our species. The habit of partial co-operation is eminently fitted to develope the social instinct by means of intellectual reaction, by inspiring each family with a constant sentiment of its close dependence upon every other, and at the same time, of its own personal importance, each being enabled to consider itself as fulfilling in a certain degree a real public function indispensable to the general economy, and inseparable from the entire system.

Thus considered, social organisation tends to repose on an appreciation of individual differences, by dis-

tributing employments in such a manner as to place each in the position he can best fill, not only in accordance with his own vocation, but also with his education and actual position. Such is, at least, the ideal type to be henceforth conceived as the fundamental limit of Order. To complete the indispensable sociologic appreciation of this distributive and special co-operation, we must examine the obligations imposed by its inconveniences. In this examination will be found the real scientific germ of the co-relation necessary between the idea of society and the idea of government.

The increasing speciality of ideas and daily relations must tend to narrow the intellect, although sharpening it incessantly in one direction, and still more to isolate particular interest from a common interest; whereas the social affections, gradually concentrated between individuals of the same profession, become more and more estranged from all other classes for want of sufficient community of manners and ideas. It is thus that the same principle which has alone permitted the development and extension of general society, in another aspect menaces to decompose it into a multitude of corporations, which seem hardly to belong to the same species.

The social distinction of government appears especially to consist in restraining and preventing as much as possible that fatal tendency to dispersion of ideas, sentiments, and interests. It is clear, that the only means of preventing such a dispersion consists in converting this indispensable reaction into a new and special function, susceptible of interfering in the habitual accomplishment of all the various particular functions of social economy, to bring back constantly the feeling of common solidarity. It is thus that the participation of government should be understood in the fundamental development of social life, independently

of the commoner attributes of material order, to which many writers endeavour to reduce its general destination in the present day.

The gradual subdivision of employments must establish an ever-increasing subordination which tends more and more to the growth of government out of the very heart of society itself. The various special operations naturally become placed under the direction of those which rank immediately above them in the scale of generality. This subordination is not only material, as is usually supposed; it is also moral and intellectual; that is to say, it demands, beyond practical submission, a certain corresponding degree of real confidence, either in the capacity or probity of the special organs, to which a hitherto universal function is thus entrusted.

It is necessary to remark that moral and intellectual forces do not in themselves constitute a real entire composition, in the simple manner of the physical forces: thus, although eminently susceptible of social co-operation, they are less fitted for direct co-operation; whence results a fresh cause of the more radical inequality which they tend to establish among men.

If the thing to be done is a struggle of strength or wealth, whatever may be the superiority of an individual or of a family, a numerous coalition of the meanest social individualities will easily surpass it. But on the contrary, if the undertaking depend on high intellectual power, such as a vast scientific or poetical conception, there is no collection of ordinary minds, however extensive, which could in any way compete with a Descartes or a Shakspeare. It is on account of this eminent privilege that intellectual and moral forces necessarily have tended more and more to rule the social world, ever since a proper division of human employments has permitted their development.

Such is, therefore, the tendency of all society towards government. This tendency harmonizes in our indivi-

dual nature with a corresponding system of special tendencies, some towards command, some towards obedience. If men were naturally as ungovernable as is often supposed, how could they ever have been disciplined? It is evident, on the contrary, that we are all more or less inclined to respect involuntarily in our fellow creatures any superiority whatever, but especially a moral or intellectual superiority, exclusively of all personal desire to see it exercised for our advantage. Thus the spontaneity of the various individual dispositions is in harmony with the course necessary for establishing that political subordination.

SECTION V.

SOCIAL DYNAMICS.

In the preceding static considerations, we have seen *individual* life characterized by direct predominance of personal instincts,—*domestic* life by the continuous operation of sympathetic instincts,—and *social* life by the special development of intellectual influences. This scientific connection presents the practical advantage of preparing the rational co-ordination of universal morality, at first personal, then domestic, and finally social; the first subjecting the preservation of the individual to a wise discipline; the second trying to secure the predominance of sympathy over egotism; and the last, directing more and more our various inclinations according to the luminous indications of Reason, always occupied by the consideration of the general economy so as to make all the faculties of our nature concur in one common object, in accordance with the laws proper to each.

After this preliminary indication of the elementary theories of sociologic Statics, we now proceed to the study of Social Dynamics, first making an examination of human evolution considered as a whole.

We must place intellectual evolution as the necessarily predominating principle of the complete evolution of Humanity. Although our feeble intelligence doubtless needs the first awakening and continuous stimulus of appetites, passions, and sentiments, it is under intellectual direction that human progress has always been accomplished. It is only thus, and by the increasing influence

of intelligence over the conduct of man and of society, that the gradual advance has been able to acquire those characteristics of consistent regularity and persevering continuity which distinguish it from the vague and incoherent efforts of the higher animals.

It is therefore an appreciation of the system of human opinions,—in a word, the general history of Philosophy, theological, metaphysical, and positive, which must necessarily preside over a rational co-ordination of our historical analysis. Now the true scientific principle consists in the great philosophic law on the constant and indispensable succession of three general states,—primarily *theological*, transitorily *metaphysical*, and finally *positive*,—through which our intelligence passes in all speculations.

In order that this law may properly fulfil its scientific destination, it only now remains to establish as a principle, that *material* development must follow a course not only analogous, but even perfectly corresponding to that of *intellectual* development.

All the various general methods of investigation applied to political researches have shown the primitive tendency of man to a *military* life, and his final destination to an essentially *industrial* existence.

Thus, no one will refuse to acknowledge the continual decrease of the Military spirit, and the gradual ascendancy of the Industrial, to be a twofold consequence of our progressive evolution. The antipathy of primitive races for all regular labour evidently leaves man no sustained exercise of activity but that of military life, the only one for which he is then fitted, and which, moreover, constitutes the most simple means of procuring his subsistence.

It is easy to conceive that whatever may be now the social preponderance of the industrial spirit, our material evolution long demanded an exclusive ascendancy of the military spirit, under the empire of which alone could

human industry be properly developed. The social and above all the political properties of military life are in conformity with the high civilizing function which they have to fulfil, and Carlyle's one model Institution, his one example of successful government, is "The Soldier."

These attributes are admirably adapted to the nature and wants of primitive society, which doubtless could not have learnt Order in any other school but War, as may be inferred even in the present day, from those exceptional individuals whom industrial discipline cannot sufficiently mollify, and who in that respect represent as nearly as possible the original human type.

To say the truth, the military régime must everywhere have had, as an indispensable political basis, the individual slavery of the producers, in order to permit the warriors the free and full development of their characteristic activity. The institution of ancient slavery was therefore destined to organize a gradual preparation of industrial existence. However unexceptionable the political necessity of a long preponderating exercise of military activity, it is impossible to be blind to the essentially *provisional* nature of such a social destination, the importance of which must have constantly decreased as industrial existence was able gradually to develope itself.

It is impossible not to be struck by the analogy of this progression with Comte's law of mental evolution, *i. e.* the necessary succession of the three principal states of human intelligence, and also with the embryological Law of provisional organs I have adduced in illustration (see Part I. Sect. III.)

But besides this similarity, it is important to recognize the connexion of the two evolutions, by characterising the natural affinity which must always have existed, at first between the *theological* and the *military* spirit, then between the *scientific* and the *industrial*

spirit, and consequently also, between the two transitory functions of *metaphysicians* and *lawyers*. The fundamental bond which spontaneously unites theological to military power has always been keenly felt and highly respected, in spite of political rivalries, by all men who have shared in either one or the other.

It may easily be conceived that no military régime could be established without first resting on a theological consecration, without which the requisite subordination would be neither complete enough nor enduring enough. A profound examination will in the same way show the necessary efficaciousness of the military régime in consolidating and extending theological authority, thus developed by a continual political application, as the priestly instinct has always felt.

It may be observed that the religious spirit is as antipathetic as the military spirit to a preponderance of the industrial spirit. According to the barbarous but rigorous logic of uncultivated peoples, all active intervention on the part of man to ameliorate the economy of nature for his own benefit is an outrage upon Providential government! For what is industry but the subjugation of Nature by man? what is it but man creating for himself, instead of accepting what the gods vouchsafe?

It is certain that too absolute a preponderance of the religious spirit necessarily tends of itself to check the industrial tendency of Humanity, by an exaggerated sentiment of foolish optimism.* It is impossible to deny the high political influence by which industry must aid the progressive ascendancy of the scientific spirit in its antagonism to the religious spirit.

We here terminate the rapid analysis of Comte's principal views with respect to the dogmatic bases of

* Is not the use of Chloroform stigmatized as a presumptuous and impious attempt to evade pain ordained by the Creator?

Sociology. When the reader reflects that in the foregoing pages a volume of upwards of seven hundred pages has been compressed, he will appreciate the necessity for a more careful and detailed examination of the original if he wish for satisfaction on any of the topics here so briefly indicated. He must take these pages as a sort of extended *syllabus* of a course of Lectures—a preparatory bird's eye view, enabling him to study the details with a full consciousness of their bearing.

We now pass to Comte's Philosophy of History, wherein we shall see his sociological law applied to the whole past evolution of Humanity.

SECTION VI.

AGES OF FETICHISM AND POLYTHEISM.

THE historical analysis now to be sketched will concentrate itself upon *one* social series; that is to say, it will consider exclusively the actual development of the most advanced populations; putting aside the other centres of independent civilization whose evolution has hitherto been impeded: unless the comparative examination of these accessory series should be of use in throwing light upon the principal subject. It is only after having thus determined what is suitable to the elect of the human race, that it becomes possible to regulate a rational interference in the development of the less advanced races.

The first intellectual condition of man must have necessarily begun by a state of pure *fetichism; i. e.* by our primitive tendency to conceive all exterior bodies as animated with a *life* essentially analogous to our own. Although we are now sufficiently removed from Fetichism, to have some difficulty in conceiving it, each of us has but to retrace his own individual history to find it a faithful representation of such an initial state. Fetichism constitutes the foundation of the *theological* spirit, both in its elementary simplicity and in its intellectual plenitude. It is there that the celebrated formula of Bossuet, "Every thing was God, except God himself," would be eminently appropriate. Never could the spirit of religion have been more directly opposed to any true

spirit of science, with respect to even the simplest phenomena, as in that first age.

The idea of *invariable laws* must at that time have appeared eminently chimerical; indeed, had it arisen it would have been immediately repulsed as radically opposed to the consecrated method, which attached the explanation of every phenomenon to the *arbitrary will* of the corresponding *fetiche*. Considered in its relation to the Fine Arts, the general action of Fetichism upon the human intellect is certainly not nearly so oppressive as it is in a scientific point of view. It is, indeed, evident that a philosophy which animated directly the whole of nature, must have tended to favour the spontaneous impulse of the imagination, at that time necessarily having a mental preponderance. Thus, the earliest attempts in all the fine arts, not excepting poetry, are to be traced to the age of Fetichism. As to industrial development, philosophically defined, that is to say, embracing the entire action of man upon the exterior world, it is to be traced to this first social age; when man laid the basis of his conquest of the terrestrial globe.

Industry owes to this age the first indication of its most powerful resources: the association of man with animals capable of being disciplined, the permanent use of fire, and the employment of mechanical powers; indeed, Commerce properly so called here finds its first distinct impulse in the institution of money. In one word, almost all the industrial arts and agencies have here necessarily their origin. Fetichism presents in an eminent degree that valuable quality inherent in the theological system, of favouring the first efforts of human activity by the illusions which it inspires concerning the supremacy of Man, to whom the whole world must appear to be subordinate as long as the invariability of the laws of nature remains unrecognised.

Although that supremacy could not be realisable at the time except by the intervention of divine agency, it is evident that the continuous sentiment of this supreme protection must have been, at that epoch, eminently calculated to excite and sustain the active energy of man. Lastly, in the social point of view, Fetichism displays real properties of the highest importance. A careful induction will make us feel the necessity of a theological consecration in those social modifications in which we are now-a-days the least disposed to conceive its influence. It is thus we find even the simplest hygienic precepts could at first be established only under the high authority of religious prescription. In the same way it appears very probable that a religious influence contributed greatly, in early times, to establish, and above all regulate, the continuous use of dress, justly regarded as one of the principal indices of a rising civilization.

In spite of the vain reputation of extreme political ability which we are so strangely tempted to attribute to dissimulation and even to hypocrisy, it is happily indisputable that the legislators of primitive times were as sincere, in general, in their theological conceptions regarding society, as in those which regarded the external world.

All the great successive modifications of the religious spirit have been determined at first by the development of the scientific spirit. The insensibly increasing generalization of the diverse observations upon Humanity must necessarily have led to analogies in corresponding theological conceptions, and thus determined the transformation of Fetichism into a simple Polytheism. For the gods differ essentially from the pure fetiches in their more general and abstract character. Each administers a special order of phenomena, but at the same time in a great number of bodies, so that each has a more or less extensive department, whereas

the humble fetiche governs only one object, from which he is inseparable.

Thus, in proportion as the essential similitude of certain phenomena was recognized in diverse substances, it became necessary to assimilate the corresponding fetiches, and finally to reduce them to the principal amongst them, who from that moment was raised to the rank of a god; that is to say, of an ideal and habitually invisible agent, whose residence was no longer rigorously determined. Properly speaking there could not exist a fetiche common to various bodies. That would be a contradiction, each fetiche being necessarily endowed with a material individuality. When, for example, the similar vegetation of the different trees in a forest of oaks led men at last to represent in their theological conceptions the phenomena common to all, this abstract being was no longer the fetiche of any particular tree; he became the god of the forest.

Here, then, is the intellectual passage from Fetichism to Polytheism reduced to the inevitable preponderance of general over individual ideas in the second age of our infancy, social or personal. The impulse given by Polytheism to the imagination of man, as well as its eminent social efficacy, should incline us to look upon this second age as the true date of the most intense development of the religious spirit. If we compare in thought the daily course of active life of a sincere polytheist with that of the most devout monotheist, we shall recognize, contrary to ordinary prejudices, the more intimate supremacy of the religious spirit in the former, whose intelligence is perpetually assailed on almost every occasion and under the most varied forms, with a crowd of theological explanations of the most detailed description.

Confining ourselves, for example, to the single case of visions or apparitions, according to modern theology they are eminently exceptional, and exclusively reserved

for some privileged individuals, with whom they have almost always an important destination; whereas in pagan times every man had experienced, even on slight occasions, frequent personal relations with various divinities, with whom he was even sometimes united by direct relationship. The moral and social efficacy of Polytheism can be thoroughly appreciated only by comparing it with its principal office in human development, an office which essentially differs from that of Monotheism: from this point of view it is evident that the political influence of the one was certainly neither less extended nor less indispensable than that of the other.

In order to appreciate more completely the general participation of Polytheism in the evolution of human intelligence, it is necessary to examine it separately,—first under the scientific point of view, afterwards under the artistic or poetic point of view, and lastly under the industrial point of view. Under the first of these aspects, philosophers have hitherto appreciated too lightly the capital importance of the decisive step taken by the human intellect, when it raised itself from Fetichism to Polytheism, properly so called. This grand creation of gods constitutes the first general effort of purely *speculative* activity, which had hitherto in fact done nothing but yield to the spontaneous tendency to give direct animation to all objects in proportion to the intensity of their phenomena.

Whilst Polytheism, after having awakened speculative activity, gave thus a feeble rudimentary impulse to the scientific spirit, it tended on the other hand to philosophical meditation, by establishing a primary fundamental connexion between all ideas whatsoever, which, in spite of its essentially chimerical nature, was then of infinite value. Never since that epoch have human conceptions possessed in any comparable degree that grand character of unity of method and homogeneity

of doctrine, which constitutes the absolutely normal state of our intelligence, and which it had then spontaneously acquired under the free and uniform dominion of the theological system, placing itself immediately at the source of everything, and leaving nothing without some sort of connexion and application, through the uniform application of its religious conceptions. It is only to the yet more pure and more universal preponderance of Positive Philosophy that it will pertain, in the approaching future, to realize in a much more perfect and durable manner this fundamental property.

In a more special and direct point of view, we cannot but recognize that this religious philosophy, although made up of fiction and inspiration, tended directly to excite a certain elementary development of the spirit of observation and induction. Even the superstitions which at this day appear to us the most absurd, such as divination by the flight of birds, by the entrails of victims, &c. &c., had primarily, besides their great political importance, a progressive character which may truly be called philosophical.

It is, for example, undeniable, as Kepler has justly remarked, that astrological chimeras served for a long time to keep up the taste for astronomical observations, after having first inspired it; it is thus, likewise, that anatomy must necessarily have collected its first materials from the discoveries resulting spontaneously from the attentive examination of the liver, heart, lungs, &c., of the sacrificed animals.

As regards the artistic influence of Polytheism, it is necessary to rectify an irrational exaggeration which is still too common, and which attributes to the fine arts so fundamental an office in the society of antiquity, that its general economy would have had really no other intellectual basis. In the age of Polytheism, as in every other age of Humanity, the aim and action of the fine

arts has always reposed upon a pre-existent and unanimously admitted philosophy. Although, by an unavoidable reaction, the poetic influence doubtless contributed greatly to extend and consolidate the theological empire, it certainly could never have established it. Neither in the individual nor in the species, could the faculty of expression ever have had dominion over the faculty of conception, to which it is by its very nature subordinate, whatever may have been the successive development of the one or the other. Any real inversion of this elementary relation would tend directly to the fundamental disorganization of the human economy, individual or social.

After this explanation, we shall be able to appreciate the impulse which polytheism must have given to the fine arts, and which raised them at that time to a degree of social importance never since equalled.

We must in the first place consider as eminently favourable to the general advance of the fine arts, the fundamental property of Polytheism: that of awakening in the most spontaneous manner the free development of imagination, erected thus into the principal arbiter of primitive philosophy, inasmuch as it was directly invested with the special designation of the various fictitious beings, to whom the production of all phenomena whatsoever was attributed. Such a religious constitution attributed to the æsthetic faculties a participation accessory, and nevertheless direct, in all theological operations; whilst under monotheism the fine arts have been reduced to the office of ministry, or at the utmost of propagation, without being allowed any part in dogmatic elaboration. Lastly, the general development of the fine arts was directly favoured by Polytheism, on account of the eminently popular basis which such a religion insured to the æsthetic action.

The fine arts, more especially dedicated to the masses, must from their nature feel the need of resting upon a

system of familiar and common opinions, the supremacy of which is equally indispensable to their production and enjoyment. It is the absence of this condition in modern art which explains the small effect produced by so many chef-d'œuvres. Now the æsthetic superiority of Polytheism is yet more irrefutable in this respect than in any other, for no other philosophy could have since obtained popularity at all comparable at the period of its preponderance. Monotheism itself, at the time of its greatest splendour, was certainly not as popular as this antique religion, the moral imperfections of which helped to increase and propagate its influence.

The necessary aptitude of Polytheism to second the æsthetic evolution of Humanity is thus explained. In the true system of human economy, social or individual, the æsthetic faculties are, in some sort, intermediate between the purely moral and the purely intellectual faculties. Their proper development may happily react at once upon the mind and the heart; thus constituting one of the most powerful agents of education, intellectual or moral, that we can conceive.

If the characteristic of the human race began to announce itself from its earliest infancy by the ascendancy of sentiment over animal instincts, which was the result of Fetichism, it is impossible to doubt that the preponderance of imagination over sentiment, *i. e.*, the æsthetic evolution in a state of Polytheism, must have been a great step towards the definitive state in which reason will openly take the reins of human government: a situation into which Monotheism tended strongly to bring us, but which cannot be completely realized except under the universal empire of positive philosophy. This appreciation serves to solve the great objection which the fine arts offer to the theory of human progress, by the single fact of their undeniable pre-eminence at a time which in every other respect evidently represents but the infancy of our species.

We see now, indeed, by what a concourse of natural causes the principal rise of the fine arts must have taken place under the empire of Polytheism, without such a correspondence giving any reasonable indication of a real ulterior diminution in the integrity of our æsthetic faculties. The fine arts having to depict our moral and social existence, it is clear that although suitable to every phase of Humanity, they must adapt themselves by preference to the most homogeneous and fixed state of society, the character of which being more complete and well marked, admits of a more definite representation; and this was the case under the empire of Polytheism. We shall recognize, on the other hand, that from the beginning of the middle ages the modern social condition was, so to speak, one immense *transition*, without any sufficiently marked physiognomy. Various causes have concurred to slacken the march of the fine arts; and yet, far from having undergone any real degeneration, facts prove with startling evidence that the genius of Art has raised itself, in almost every line, to the level and even above the level of the most eminent productions of antiquity, independently of the new path which it has opened to itself by many admirable chef-d'œuvres. When, after a long and severe preparation, modern civilization shall have finally developed its true character by the general ascendancy of positive philosophy, Humanity will elevate itself to a social state at once eminently progressive and yet more homogeneous and stable than that of polytheistic antiquity, in which the fine arts will find a new scope and new attributes, as soon as their genius shall have adapted itself to the new intellectual system.

Polytheism, whilst it constituted the sole philosophy capable of giving a primary impulse, whether scientific or æsthetic, to the human mind, caused on the other

hand the double institution of a regular worship and a distinct priesthood, which alone can allow of the growing establishment, among different families, of a true social organization susceptible of consistency and duration. In this phase of society, the nature of the worship, admirably adapted to the correlative condition of Humanity, consists, for the most part, of numerous and varied festivals, in which the first efforts of the fine arts find daily a happy means of exercise, and which frequently constitute the principal motive for habitual assemblies, among populations connected by a common language. Polytheism was in political harmony with the wants and condition of the human race, as well as with the true nature of the then prevailing system.

Social activity would be essentially military. Although, in modern times, war, radically exceptional, has become rather fatal than favourable to the extension of the social relations, it is clear that with the ancients the successive annexation by means of conquest of divers secondary nations to one preponderant people, constituted the only means of increasing society, of instituting permanent peace, and of conducting man to a purely industrial life. When we believe that with the ancients wars had nothing to do with religion, it is in consequence of an abusive extension of the point of view peculiar to modern nations, with whom the spiritual and the temporal are distinctly separated, whereas, in ancient times, they were intimately connected. If we may say, in one sense, that the ancients knew no such thing as a "religious war," it is precisely because all their wars had necessarily a religious character, as we may still see in analogous phases of society: since the gods were then essentially national, their quarrels were inevitably mixed up with those of the nations in whose triumphs and reverses they always partook.

Polytheism thus gave a direct stimulus to the spirit of

conquest, and insured the principal social destination, by facilitating the gradual assimilation of the subjugated peoples, who could then incorporate themselves with the preponderating nation without renouncing the religious creeds and practices which were dear to them. Monotheistic fanaticism does not inspire the spirit of conquest properly so called, because such a religion cannot admit of a real union with other creeds: its exclusive genius must naturally provoke it to the entire extermination of the vanquished idolaters, or to their perpetual servitude, except in cases of immediate and complete conversion.

It would be useless to explain how Polytheism afforded the most powerful resources for the establishment and maintenance of a rigorous military discipline, whose various prescriptions could then be so easily placed under a divine protection, always aptly selected, by means of oracles, auguries, &c. &c. constantly at command, in accordance with the regular system of supernatural communications which Polytheism had organized, and which Monotheism was forced to suppress.

To complete this appreciation of the political properties of Polytheism, we have now only to consider the instititution of Slavery, and the confusion of the spiritual and the temporal powers; a twofold capital difference between the polytheistic organization of ancient society and the monotheistic social organization of modern times. One may easily perceive how war engenders slavery, which finds in it at once its principal source and its first general corrective. The horror with which this institution inspires us now prevents our appreciating the immense progress which must have resulted from its original establishment, since it everywhere succeeded to anthropophagy or immolation of prisoners; a progress which supposes a far more extended development, both industrial and moral, than is

generally believed. Slavery had another office most important to the ulterior development of the human race: it instituted *labour!*

The more we meditate upon the profound aversion which any regular and sustained labour inspires in our defective nature, primitively to be roused from its dearly loved idleness by warlike instincts alone, the more clearly we shall perceive that slavery afforded the only issue for the industrial development of the human race. This dislike to a laborious life could, indeed, only be radically surmounted, with the mass of mankind, by the combined and sustained action of the most energetic stimulants; and this would be the result of slavery, in which labour, accepted at first in exchange for life, became in the sequel the means of acquiring freedom. Such is the method by which the slavery of ancient times constituted, in the evolution of humanity, a means of general education, and at the same time a condition of special development.

Let us now examine the second character of ancient social economy; that is, the confusion manifested in every way between the spiritual and the temporal power, habitually concentrated in the same person, while their regular separation constitutes one of the principal political attributes of modern civilization. Speculative authority, at that time purely sacerdotal, and executive power essentially military, were always united; and this unavoidable combination had a necessary relation to the general destination recognized above, as proper to this system for the entire evolution of humanity. It is clear, indeed, that military activity could not have developed itself so as to fulfil its principal mission, if spiritual authority and temporal power had not been habitually concentrated in one directing class.

This twofold character of the military chiefs, at once

pontiffs and warriors, constituted the most powerful support of that severe internal discipline rendered necessary by the nature of the wars, and which could not otherwise have acquired the necessary energy and stability. In the same way, the collective actions of every nation upon exterior societies would have been radically checked by any separation between the two authorities, whose conflicts would then have tended almost always to trouble the direction of the wars, and to hinder the final realization of the principal results. Thus, within and without, the continuous development of the spirit of conquest required, in ancient times, a plenitude of obedience and a unity of conception and execution, equally incompatible with our modern ideas of the elementary division of the two great social powers. Now polytheism was radically incompatible with any such division. It is evident, indeed, that the multiplicity of the gods, by the dispersion of theological action resulting therefrom, opposes itself directly to the acquirement by the priesthood of the homogeneity and consistency proper to it, and without which its independence of the temporal power can never be at all insured.

The principal properties of polytheism being now distinctly characterized, we have only to examine it under the moral point of view. Under whatever aspect we regard morality, personal, domestic, or social, we cannot but recognize how profoundly vitiated it must have been, among the ancients, by the sole fact of the existence of slavery. In all that concerns individual morality it would be superfluous to pause here to demonstrate the degradation to the greater part of our species which directly results from it. Relatively to domestic morality, in particular, we cannot doubt that slavery tended to corrupt the most important family relations, by the deplorable facilities it afforded to libertinism, so as to render almost illusory the attempt to establish monogamy.

As regards social ethics, of which general love of human nature ought to constitute the principal character, it is only too easy to perceive how much the universal habits of cruelty, familiarly contracted towards unfortunate slaves, tended to develope the sentiments of harshness and even ferocity which in so many respects were ordinary characteristics of ancient manners.

Considering the other political conditions of ancient societies, we recognize upon no less certain evidence the fatal influence which must in general result from the confusion between the spiritual and the temporal power. It is, indeed, a consequence of such confusion that morality with the ancients was made essentially subordinate to policy: whereas with the moderns, especially under the reign of Catholicism, morality, radically independent of policy, has tended more or less to direct it. So vicious a subjection of the general and permanent point of view—*morality*,—to the special and vacillating point of view—*policy*,—must have affected the efficacy of moral prescriptions.

However unavoidable such an imperfection may then have been, it is not the less to be deplored. It is evident that the morality of the ancients was in general, like their policy, eminently military: that is to say, essentially subordinate to the warlike destination which especially characterized this age of humanity. By applying the general morality of the ancients according to their own spirit, that is, with an eye to their policy, we shall find it very satisfactory, from its admirable fitness to assist the characteristic development of their military activity. But it is, on the contrary, very imperfect when considered as a phase in the purely moral education of mankind.

Such was ancient Polytheism, considered in its essential properties, social or intellectual, and its tendency to

produce the new theological phase, which in the middle ages, after having realized all the social efficiency of which such a philosophy was susceptible, rendered the ulterior advent of positive philosophy not only possible but indispensable; as now remains to be shown.

SECTION VII.

CATHOLICISM: MIDDLE AGES.

It was Catholicism alone, justly entitled Roman, that could work out in western Europe the characteristic properties of the monotheistic system. As the introduction of a spiritual power entirely distinct from and utterly independent of temporal power, constituted in the middle ages the principal attribute of such a political system, we must proceed to an appreciation of this grand social creation.

The eminently social genius of Catholicism consisted in its making a way for morality to penetrate gradually into policy, to which it had hitherto been subordinate, by the constitution of a purely moral power distinct and independent of the political power. This tendency constitutes the superiority of the civilization of modern times over that of antiquity. All true policy began from that time to acquire, in an intellectual point of view, a character of wisdom, of extension, and of rationality, which could never hitherto have existed.

Morally considered, it cannot be doubted that this admirable modification of the social organization must have tended to develope, even in the lowest ranks of the people who were able to feel its salutary influence, a profound sentiment of dignity and elevation hitherto almost unknown; by the simple fact, that a universal code of morality, unanimously accepted, apart from and above mere policy, spontaneously gave authority to the poorest Christian to remind the most powerful prince of the inflexible prescriptions of their

common doctrine, the primary basis of respect and obedience.

Under a purely political aspect, it is evident that this social regeneration essentially realized the grand Utopia of the Greek philosophers, since it constituted, in the midst of an order founded entirely upon birth, fortune, or military deserts, an immense and powerful class, in which intellectual and moral superiority was openly avowed as the first title to real ascendancy. No philosopher can now-a-days refuse to recognize in principle the characteristic aptitude of a spiritual organization to an almost indefinite territorial extension, wherever there exists a sufficient similitude of civilization to admit of the regularization of habitual or continuous intercourse. It is irrefutable that the papal monarchy constituted in the middle ages the principal general tie between the various European nations, from the time the dominion of ancient Rome lost the power of concentrating them sufficiently.

If we examine the ecclesiastical constitution, we cannot be surprised at the political ascendancy which a power so strongly organized, equally superior to all that surrounded and to all that had preceded it, acquired universally in the middle ages. Directly founded upon intellectual or moral merit, the Catholic organization gradually attributed to the elective principle an extension hitherto unknown; since the choice, always restricted in the ancient republics to one fixed class, might now embrace the whole of society, not excepting the lowest ranks, which at that time did, in fact, furnish so many Cardinals and even Popes; on the other hand, under a less well-understood but not less important aspect, it perfected the nature of this political principle by rendering it more rational, inasmuch as it substituted the choice of superiors, by their inferiors to the inverse disposition, hitherto exceptional. The characteristic method of election to the supreme spiritual dignity must always be

regarded as a triumph of political wisdom, in which the general guarantees of real stability and fitting preparation were far better insured than by the empirical expedient of hereditary right.

We must equally recognize the great political importance, until the decline of the system, of those Monastic Institutions which, setting aside their intellectual services, constituted certainly one of the most indispensable elements of this immense organization. These peculiar institutions, now known almost entirely by the abuses of their decadence, were the cradle in which the principal Christian conceptions, dogmatical and practical, were elaborated long before their promulgation.

The chief efficacy common to all the various political properties of the Catholic constitution consisted especially in this powerful education of the clergy, which rendered the ecclesiastical genius habitually so superior to all others, not only in enlightenment but also in political aptitude. Let us point out also another characteristic of deep political philosophy in the discipline by which Catholicism gradually restrained the right of supernatural inspiration—representing it as eminently exceptional, confining it to cases of more and more gravity, to the more and more elect, to times farther and farther removed from each other; subjecting it, lastly, to verifications of authenticity more and more severe. Its regular and continued use was reduced to what the nature of the system rendered strictly indispensable, as soon as all divine communication became, in principle, reserved for the most part to the supreme ecclesiastical authority. This papal Infallibility, now made so bitter a reproach to Catholicism, constituted in truth a very great intellectual and social progress. If we take from the sovereign Pontiff this indispensable prerogative, the spirit of Protestantism, far from suppressing the right of divine inspiration, tended directly on the contrary greatly to augment it, and to cause

a retrogression in the gradual development of the human race.

The important institution of ecclesiastical Celibacy has been justly regarded as one of the essential bases of sacerdotal discipline. Men have not sufficiently appreciated the bold and really fundamental innovation operated in the social organization by Catholicism, when it thus suppressed for ever the hereditary priesthood, profoundly inherent in all the economy of antiquity, not only under the so-called *theocratic* system, but also among the Greeks and even among the Romans, with whom the various pontifical offices of any importance constitued the exclusive patrimony of a few privileged families—or, at the very least, of a certain caste. This general institution of ecclesiastical celibacy was essentially destined to render a pure theocracy radically impossible, guaranteeing to every rank of society, in the most special manner, legitimate access to all spiritual dignities whatsoever.

Another peculiar condition of the political existence of Catholicism in the middle ages, consists in the necessity of a temporal principality of sufficient extent, directly annexed to the head-quarters of spiritual authority, in order better to guarantee its entire European independence. Issuing, as at this day we are too ready to forget, from a social state in which the two elementary powers were confounded together, the Catholic system would then have been rapidly absorbed, or rather annulled, politically, by the preponderance of the temporal power, if the seat of its central authority had been shut up in any one particular jurisdiction; the chief personage in which would not have failed, following the primitive tendency towards the concentration of all powers, to subject the Pope to himself as a sort of chaplain. But, on the other hand, the indubitable necessity of this temporal addition to the supreme ecclesiastical dignity, should not make us forget the grave

and inevitable inconveniences resulting from it, whether as regards the sacerdotal authority itself, or the part of Europe reserved to this sort of political anomaly.

Let us now consider the great attribute of general Education, which, according to our anterior explanation, constitutes the most important function of the spiritual power, and the foundation of all its other operations. Almost all philosophers, even the Catholics, for want of a sufficiently elevated comparison, have appreciated too lightly the immense social innovation accomplished by Catholicism when it directly organized a system of general education, intellectual as well as moral, extending itself to every class of the European population, without any exception whatever. It is easy to perceive the eminent social value of such a permanent amelioration, starting from the polytheistic system which condemned the mass of the population to a state of brutalization.

Lastly, we must look upon the truly capital institution of *Confession* as a necessary complement of this attribute, for it is on the one hand impossible that the real directors of youth should not become spontaneously in a certain degree the counsellors of active life; and on the other hand, without such prolongation of their moral influence, their social efficacy would not have been secured, in virtue of their fitness to overlook the daily execution of the principles of conduct they had themselves imparted. Who does not feel the powerful moral effects of this beautiful institution to purify by confession and rectify by repentance?

To complete the comprehension of this grand organization, we have to point out its principal dogmatic conditions, in order to make it apparent that the secondary theological creeds, at present commonly regarded as socially indifferent, were nevertheless indispensable to the full political efficacy of this system.

Catholicism, to constitute and maintain the unity necessary to its social distinction, was forced to put a check at once on the free, individual, inevitably discordant, expression of the religious spirit, by erecting into the first duty of a Christian, the most absolute Faith. Without this basis, all other moral obligations would have immediately lost their only fulcrum. The famous dogma of the Fall and original Sin, constituted also a necessary element of the Catholic philosophy, not only by its relation to the theological explanation of human suffering, but also, in a more special manner, by providing a motive for the necessity of an universal Redemption, upon which rests the whole economy of the Catholic faith.

It would be easy, in the same way, to show that the institution of Purgatory, so bitterly criticized, was most happily introduced at first into practical Catholicism as an indispensable corrective of the eternity of future punishment, whatever may since have been the abuses of so arbitrary an expedient. Among the special dogmas an analogous examination would place in full evidence the political necessity of the eminently divine character attributed to the first founder, real or ideal, of this grand system of religion, in consequence of the profound and indisputable, though hitherto ill-understood, relation of such a conception with the radical independence of the spiritual power, thus placed at once under the protection of an inviolable authority.

The celebrated dogma of the *real presence*, which, in spite of its apparent strangeness, constituted in fact a natural prolongation of the preceding dogma, contained in itself the same political efficacy, attributing as it did to the most ordinary priest a daily power of miraculous consecration, tending to render him an object of veneration to those chiefs whose material power, however great, could never aspire to such sublime operations. The Catholic Mass is a happy invention of the theological

mind; destined to replace universally and irrevocably the hideous and bloody sacrifices of Polytheism, it contrived by a sublime subterfuge to satisfy beyond all anterior possibility the instinctive demand for sacrifices necessarily inherent in every system of religion, by this voluntary daily immolation of the greatest victim imaginable.

After having thus traced the character of the monotheistic system, relatively to its spiritual organization, which constituted its principal foundation, it is easy to proceed to the philosophical examination of its corresponding temporal organization. When we compare the Feudal with the Roman system of government, we shall easily recognize that in spite of the general prolongation of the military system, it had undergone in the middle ages an important transformation resulting from the new situation of the civilized world. Military activity, although strongly developed, had begun to divest itself more and more of the eminently offensive character it had hitherto assumed, and to reduce itself gradually to a purely defensive character.

When once the Roman system of conquest had acquired all the plenitude of which it was susceptible, by a natural transition military efforts were turned habitually to conservation, now their only great object, and daily more and more menaced by the growing energy of the unconquered nations. Each military chief holding himself constantly in readiness for the defence of his territory, tended spontaneously to the erection of an almost independent power over that portion of country which he was capable of protecting sufficiently himself, with the assistance of those warriors who had attached themselves to his fortunes.

The influence of Catholicism is not less discernible in the universal transformation of *slavery* into *serfdom*, which constitutes the last essential attribute of the feudal organization. The Catholic system interposed directly

between the master and slave, or the lord and serf, a salutary spiritual authority respected equally by both, and continually recalled them to their respective duties.

Lastly, we must here consider the grand institution of Chivalry, as in its nature reflecting the three characteristics of the temporal organization of the middle ages. In these noble associations, the salutary influence, ostensible or secret, of Catholicism, reveals itself, tending as it did to convert a simple means of military education into a powerful instrument of social progress.

Having thus worked out the important and difficult political appreciation, both spiritual and temporal, of the monotheistic system of the middle ages, it remains for us now to complete the analysis, by an examination of its moral influence and intellectual efficacy. We will confine ourselves to a rapid indication of the more important progress made in the three successive portions which make up the whole of Morality—firstly, *personal*, secondly, *domestic*, and lastly, *social*—following the order already established.

Catholicism, appropriating the unanimous opinion of antecedent philosophers, rightly regarded individual virtues as the basis of all others, inasmuch as they afford the most natural and most decisive exercise of that ascendancy of reason over passion, on which all moral perfection depends. The simply personal virtues began from that time to be directly regarded in all their social importance, whereas the ancients recommended them as measures of prudence, purely relative to the individual considered separately.

The moral fitness of Catholicism is peculiarly manifested in its happy organization of domestic morality, now for the first time placed in its proper rank, instead of being absorbed by policy, as in all antiquity. Catholicism, while it consecrated in the most solemn manner the authority of parents, abolished totally the almost

absolute despotism which it possessed among the ancients, and which not unfrequently manifested itself in the murder or desertion of infants at their birth. No one now disputes that it ameliorated the social position of women. By concentrating them more completely in domestic life, it guaranteed to them a just degree of liberty, and consolidated their situation by rendering marriage an indissoluble contract.

Taking into consideration mere social morality, properly so called, it is almost superfluous to demonstrate the excellent influence of Catholicism in modifying the energetic but savage patriotism which alone animated the ancients, by the more elevated sentiment of universal humanity or brotherhood, so happily familiarized under the gentle name of Charity. This was the fruitful source of so many admirable asylums destined to the relief of human wretchedness, which metaphysical policy has had the boldness to condemn in the name of the pretended science of political economy, whereas it remains for us at this day, by reorganizing, to extend and complete them.

Such is a summary representation of the immense moral regeneration established by Catholicism in the middle ages. We have now to judge of its intellectual attributes. Under a strictly philosophical point of view, the intellectual aptitude of Catholicism is as eminent as it is ill appreciated. We have already considered the extreme social importance of the system of universal education which it contrived to organize throughout all classes, even the lowest, of the European populations. Now, however imperfect may appear to us the purely theological philosophy thus spread abroad, it certainly exercised for a long time a most happy influence over the intellectual development of the mass of civilized nations, from that time regularly subjected to a spiritual exercise thoroughly adapted to their situation,

and as much calculated to elevate their ideas above the narrow circle of material life, as to purify their habitual sentiments.

The purely scientific influence of Catholicism was certainly not less salutary than its philosophical action. It is easy to imagine the influence which the monotheistic rule must exercise over the movement of the principal natural sciences: by the creation of chemistry, founded upon the preliminary conception of Aristotle relative to the four elements: by the notable progress made in anatomy, so fettered in ancient times; and by the continual development of preceding mathematical speculations and the astronomical notions connected therewith; a development as decided as the then state of science admitted. As to the æsthetic influence of the monotheistic system of the midle ages, although, in common with those above alluded to, it did not unfold itself until the period immediately following, we cannot deny its decided bias when we think of the immense progress of music and architecture during this memorable epoch.

If we regard the movement communicated by this social system under the least elevated and most universal aspect, that is, as respects the industrial Impulse, we cannot doubt but that the greatest improvement realizable in human industry must consist in a gradual and discreet abolition of serfdom, accompanied by the progressive enfranchisement of the common people, at that time accomplished under the guardianship of such a system, and which constituted the necessary basis of its immense subsequent success. We should remark a progressive tendency towards the economy of human labour replaced by exterior forces scarcely at all used by the ancients. This important substitution, the principal source of the great development of modern Industry, may be traced certainly to this date. The personal emancipation of the immediate labourers had an evident tendency to impose an impe-

rious general obligation to spare human forces by utilizing in a greater degree the various physical forces.

After this analysis of the monotheistic system, it remains for us to demonstrate, lastly, the principle of decadence inherent in this transitory system, whose necessary destination in the evolution of humanity was to prepare under its beneficent tutelage the gradual decomposition of the theological and military condition, and the advance of new elements of definitive Order.

The general cause of the inevitable mental dissolution of Catholicism consists in its never having been able to corporate itself with intellectual advancement; it was thus necessarily, after a time, outstripped; from that time it was impossible for it to maintain its empire except by abrogating the progressive character proper to every system in its rise, in order to take more and more the stationary and even retrograde character which so deplorably distinguishes it at present.

The universal morality of which Catholicism was primarily the indispensable organ, can certainly no longer constitute its peculiar property, when it has lost its aptitude to impose it upon social economy in general.

In a secular point of view the transitory nature of the feudal system manifests itself in the most unequivocal manner. As to its principal aim, the defensive organization of modern societies, it could retain no importance after invasions were put an end to, by the final transition from a barbarian state to an agricultural and sedentary life, on their own domains, sanctioned and consolidated by their gradual conversion to Catholicism, which incorporated them more and more completely in the universal system.

This transitory character is still more apparent in the decomposition of the temporal power into partial sovereignties, which we have admitted as one of the characteristics of the feudal system, and which could

not fail to be early replaced by a new centralization, towards which everything would naturally tend. The same holds good in its last characteristic feature—the transformation of slavery into serfdom—since slavery constitutes a state susceptible of any amount of duration under suitable conditions; whereas serfdom, strictly speaking, could only be in the system of modern civilization a transient condition, promptly modified by the almost simultaneous establishment of industrial communities, whose sole social destination was the gradual preparation of the labourer for entire personal emancipation.

SECTION VIII.

THE TRANSITION AGE.

STARTING from the point at which our historical elaboration has now arrived, the study of this Transition Age will constitute the object of the rest of our analysis. This will be divided into two series—one essentially *critical* or *negative*, intended to characterize the gradual demolition of the theological and military system under the growing ascendancy of the metaphysical spirit; the other, directly *organic*, relating to the progressive evolution of the various principal elements of the positive system.

Let us first estimate the increasing disorganization of the theological and military system during the course of the five last centuries. The imminent spontaneous disorganization of Catholicism was indicated, from the beginning of the fourteenth century, by grave precursory symptoms, *i. e.*, the general relation of the sacerdotal spirit, and the increasing intensity of heretical tendencies. The violent means then introduced on a grand scale for the extirpation of heresies constituted one of the most unequivocal signs of this insurmountable fatality. In temporal matters, it was then that the decrease of the feudal constitution gradually became inevitable, its principal military destination being fulfilled.

In order to analyze in a truly scientific manner this immense revolutionary work of five centuries, it must be carefully divided into two successive portions: the one, comprising the fourteenth and fifteenth centuries, in

which the critical movement remains spontaneous and involuntary, without the regular and express participation of any systematic doctrine; the other, embracing the three following centuries, during which the disorganization becoming more profound and divided, completed itself under the influence of a professedly *negative* philosophy, gradually extending itself to all social questions of any importance, so as to indicate the tendency of modern society to an entire renovation

Nothing can be a stronger confirmation of the transitory nature of the Catholic and feudal constitution of the Middle Ages, than the ruin of such an organization by the mere conflict of its principal elements, without any systematic attack, during the two centuries immediately following the time of its greatest splendour. It is unquestionable that the establishment of a Spiritual power distinct from and independent of the Temporal power, indispensable as it was to the accomplishment of the special evolution reserved for the Middle Ages, must in the sequel have become an active principle of decomposition by the incompatibility between the two authorities, from the unfitness of the only philosophy which could then preside over both. Under the true monotheistic rule, in which the separation between the moral and political government became a principal attribute, there exists an inevitable contradiction between such a disposition and the military nature of the corresponding temporal system, considering the tendency to unity of power characteristic of the martial spirit.

As to the spiritual polity, we cannot but see that the Catholic hierarchy, in spite of the superiority of its energetic co-ordination, contains in its very nature the seeds of an inevitable dissolution, as regards the general relations between the supreme sacerdotal authority and the various national churches. In the country which, according to the just and unanimous

estimate of the principal Catholic philosophers, was during the whole Middle Ages a principal support of the ecclesiastical system, the national clergy arrogated to themselves special privileges, in respect to the supreme spiritual authority, which the Popes have often proclaimed to be contradictory to the political existence of Catholicism: and this opposition could certainly not have been less real, though perhaps less distinctly expressed, among the populations more removed from the centre of pontifical power.

Papacy, on the other hand, tended in an inverse direction, but with the same efficiency, to the dissolution of this subordination, by its disposition to an exorbitant centralization, which, being for the exclusive advantage of Italian ambition, justly raised in all other places the most energetic and obstinate national resistance. Such is the twofold and continuous impulse which even prior to any doctrinal schism tended to dissolve the interior unity of Catholicism by decomposing it, contrary to the spirit of its foundation, into independent national churches.

As to the temporal organization, the fundamental antagonism between monarchial central power, and the local powers of various classes of the feudal hierarchy, has been sufficiently indicated by various writers, and especially by Montesquieu, so as to make any new examination of it here unnecessary. Comte regards this decomposition as a truly distinctive character of the feudal and Catholic system, since it was, he thinks, more profoundly marked in it than in any other antecedent system.

Such is the purely provisional destination of theological philosophy that in proportion as it perfects itself morally and intellectually, it becomes less consistent and less durable; as is clearly proved by a comparative examination of its principal historical phases: for the primitive Fetichism was really more firmly rooted and

more stable than Polytheism, which in its turn decidedly surpassed Catholicism both in intrinsic vigour and in actual duration; a paradox which our theory nevertheless resolves readily by representing the progress of theological conceptions as necessarily consisting in a continual decrease of intensity.

The *critical* or *revolutionary* doctrine evidently contributed much to accelerate and propagate the natural disorganization of the Middle Ages, and, in consequence, of the whole military and theological system of which it constituted the last phase. The development of this doctrine divides itself into two successive phases, separating this memorable historical period of the three last centuries into two nearly equal portions.

In the first phase, comprising Protestantism in its various principal forms, the "right of private judgment," although clearly enunciated, is nevertheless always confined within the limits of Christian theology; hence this anarchial spirit of discussion, ostensibly applied only to theological dogmas, was really applied, in the name of Christianity itself, to ruin the admirable system of Catholic hierarchy which constituted socially its only realization. It is in this that the illogical character inherent in the negative philosophy announces itself most distinctly, by its constant pretension to reform Christianity with means radically destructive of the conditions indispensable to its political existence.

The second phase comprises the various attempts of Deism, vulgarly known as the philosophy of the 18th century: the right of private judgment is there in principle recognized as indefinite; but the endeavours to restrain metaphysical discussion within the bounds of Monotheism was idle. The intellectual bases of Monotheism appeared immovable, but they were shaken by a prolongation of the same critical elaboration. The social incompetence of this doctrine becomes felt in the tendency to found political regeneration upon a series of

simple negations which could end in nothing but universal anarchy.

Such are the various considerations on the necessary march and concatenation of the different phases of the great movement of radical decomposition, first spontaneous and afterwards systematic, which characterizes the political evolution of modern society during the five last centuries, tending to the entire dissolution of the Catholic and feudal constitution, the last phase of theological and military development.

SECTION IX.

RISE OF THE INDUSTRIAL ORDER.

THE monotheistic system peculiar to the Middle Ages is represented by Comte as invested with a twofold destination,—temporary indeed, but indispensable to the evolution of Humanity; he has given a notion of the general development of its political consequences destined to effect the gradual disorganization of the military and theological system. We have now to pursue, with regard to this same preliminary period, which has hitherto appeared purely revolutionary, the analysis of its *social* elements, forming as they do the basis of an organization conformable with modern civilization. It is only after this second appreciation that we can adequately terminate the historical survey.

The opening of the fourteenth century represents the true epoch at which the organic working of existing societies began to be sufficiently characteristic in the quadruple series—Industrial, Æsthetic, Scientific, and Philosophical.

Let us proceed to the examination of each of these four evolutions, beginning with the Industrial, as the principal basis of the great movement of recomposition which has hitherto characterized modern society. This transformation, the most fundamental which mankind has yet undergone, has been everywhere realized by the substitution of serfdom for slavery. The cultivator, thus fixed to the ground he tilled, began immediately, however miserable and precarious may have been his existence, to acquire real social rights, at any rate the

most elementary of all,—that of creating for himself a family. Such an amelioration is the necessary basis of all the ulterior phases of civil emancipation.

From the very beginning of serfdom it is clear that Catholicism not only established everywhere a permanent sanction for the rights of the serfs, and imposed upon them corresponding obligations, by admitting them to a participation in the same religion as their superiors, and consequently in the common degree of education, moral at least, which necessarily resulted therefrom; but also that it also proclaimed, in a more or less explicit manner, voluntary enfranchisement to be the duty of a Christian, as soon as the population should at once manifest its tendency to, and fitness for, liberty.

The scattered agricultural populations, and the nature of their daily labour, tended evidently to retard both the tendency and fitness for entire personal emancipation, and the power of acquiring it. It was principally by the great reaction emanating continually from towns when the establishment of communes admitted industrial development, that during the twelfth and thirteenth centuries the cultivators of land found themselves gradually acquiring freedom in all important parts of Western Europe.

The feudal organization, by its eminently dispersive nature, would lend itself readily to the admission of the industrial communities among the numerous elements of which its hierarchy was composed, without dreading any dangerous social or political rivalry from these nascent forces, in which, on the contrary, the two principal temporal powers sought useful auxiliaries in their quarrels.

Considering successively the different elementary aspects of social life, it becomes evident that this great transformation constitutes the most important temporal evolution that human nature could experience, since it

tended to change the mode of existence, hitherto eminently warlike, and henceforward becoming more and more peaceful, among an increasing majority of civilized nations. Twelve centuries previous, if this universal abolition of slavery, and this common voluntary subjection of free men to what was then called servile labour, had been announced to the Greek philosophers, the boldest and most enlightened among them would have unhesitatingly proclaimed the absurdity of an Utopia for which nothing at that time could indicate any foundation: not having yet had the opportunity of recognizing the fact that, in the natural course of social development, gradual and spontaneous changes end by outstripping completely the most audacious speculations of primitive times.

As to the influence exercised by this great transformation upon domestic relations, it was immense, inasmuch as all the sweet emotions of family life were thus accessible to the most numerous class, in common with their masters. It is here, then, that we find the beginning of that manifestation of the final destination of almost all civilized men to a principally domestic life, which on the contrary among the ancients was interdicted to slaves, and little enjoyed even by the free classes, habitually more attracted by the turbulent emotions of public life.

Considered abstractedly, with reference to its purely social properties, it is evident that this industrial evolution tended necessarily to complete among the moderns the irrevocable abolition of castes, by pitting against the ancient ascendancy of Birth the progressive rivalry of wealth acquired by Labour. The Catholic organization had worthily commenced this change in the Middle Ages, if only by the abolition of an hereditary priesthood and the foundation of a spiritual hierarchy on the principle of Capacity. The industrial movement followed in its steps, to realize after its own manner, in the most

insignificant social functions, a transformation equivalent to the one thus already effected in the most eminent.

Lastly, if we consider the effect of the industrial evolution in modifying the most extensive social relations, it is assuredly unnecessary to insist here upon its tendency, already so marked in the Middle Ages, to connect different populations in spite of the various causes, religious and others, of national antipathies.

To complete this historical estimate of the principal motive-power of modern society, we have now only to characterize its universal development during the memorable period of the five centuries following its origin. This great preparatory epoch is divided into three consecutive phases, according with the more or less advanced state of political decomposition: the *end of the fifteenth century* serving to *separate the time in which the spiritual and temporal dissolution was chiefly spontaneous* from that *in which it gradually became systematic*; and for the last age, *the middle of the 17th century* dividing the reign of the negative philosophy into the epoch of *preliminary protestant criticism*, and that of *deistical criticism*. Thus we have three pretty nearly equal periods, comprising, the first about six generations, the second five, and the last four; at least if we consider this to end at the beginning of the French Revolution. It was principally during these two latter centuries that Industry really began to establish its irrevocable ascendancy, so as to manifest distinctly the true practical character of modern civilization.

Among the numerous institutions which at this epoch bear witness to the rising preponderance of the industrial over the military life, we will confine ourselves to the special mention of one, which certainly was the most decisive of all—the *establishment of standing armies*, temporary at the commencement of this phase, but everywhere permanent towards its end. It is an unequivocal manifestation of the increasing antipathy felt

by the new populations towards military habits, henceforward concentrated in a special minority, the proportion of which has not ceased to decrease in spite of the numerical aggrandizement of modern armies.

We find also in this important phase the spirit of modern civilization deeply impressed, even to the technological character of the great inventions which then influenced the destinies of mankind. Modern progress is essentially distinguished from ancient by the increasing tendency to substitute various exterior agencies to the physical action of man. This important difference results from the personal emancipation which has rendered the human agent so precious in modern times, whereas ancient slavery, allowing of the muscular activity of man being prodigally used, prevented any large application of natural powers.

The latter centuries of the Middle Ages had already been illustrated in this respect by three capital inventions, the origin of which has been hitherto irrationally attributed to purely accidental causes; while on the contrary it appears to us that no industrial development was ever better prepared by contemporaneous influences. We allude to the Compass, the invention of Fire-arms, and lastly that of Printing.

The origin of the Compass is to be looked for in the new situation of society, which pressed on with continuous energy to the extension and amelioration of European navigation. The influence of the same situation impelled men also in an equally powerful and direct manner to the perfecting of warlike processes, in order that the peaceable industrial populace might at last make a real stand against the attempts at oppression by the military caste. The invention of Printing was even more a necessary result of the altered position of modern society; the immense extension of a powerful European clergy naturally gave an impulse to reading; the rise of Scholasticism after the ascension of political Catholicism;

the immense concourse of eager hearers flowing by thousands into the principal universities of Europe; lastly, the entire abolition of serfdom, and simultaneous development of industrial authority, must have excited a strong desire to render the copying of manuscripts more economical and more rapid.

Such, then, is the historical explanation of the three important inventions which best characterize the first age of real industrial development. We can only here hint at the chain of causes which were to make the two immortal expeditions of Columbus and Vasco de Gama a spontaneous result of the entire movement belonging to this epoch.

In the second general phase of modern evolution, that is to say during the development of Protestantism, from the commencement of the sixteenth century till towards the middle of the seventeenth, we may perceive, under various but equivalent forms, a new and increasing tendency to the regularization of the industrial movement. In the sixteenth century, and even the seventeenth, war had not yet ceased to be regarded as the principal object of governments; but they had definitively recognized the necessity of favouring the industrial development as an indispensable basis of military power, which was assuredly the only progress realizable in the opinions of the statesmen of those days.

The tendency to the political systematization of industry must have exacted at first the sacrifice of the ancient independence of industrial cities, which, necessary to their rise, became in later days a dangerous obstacle to the formation of those great national unities so important to ulterior progress. Accordingly, this preliminary absorption, destined to incorporate every industrial centre in a more general organization, took place almost without opposition at the beginning of this epoch.

At the end of our second phase the temporal dictator-

ship had shown its true character, in France, by the system which has so justly immortalized the admirable administration of the great Colbert, tending with such splendid efficacy to develope at once the three essential elements of modern civilization by a judicious mixture of direction and encouragement.

Let us now consider the third phase of modern society, from the expulsion of the Calvinists to the beginning of the French Revolution. Here begins the last military series, that of *commercial wars*, in which, by a tendency at first spontaneous and afterwards systematic, the martial spirit, in order to preserve any active permanent destination, was forced to make itself more and more subordinate to the spirit of commerce, formerly so subaltern, and endeavoured to incorporate itself intimately with the new social economy by manifesting its peculiar aptitude either to conquer for each people useful places of establishment, or to destroy for their profit any dangerous foreign competition. Industrial activity was thus proclaimed as at once the principle and the object of modern civilization, in the temporal polity.

By a necessary consequence of its progress, modern Industry begins at this time to display directly its great philosophical character; it tends henceforward to present itself more and more as immediately destined to realize the systematic action of man upon the exterior world by a competent knowledge of the laws of nature. Two important inventions, viz., that of the Steam-engine at the beginning of this third epoch, and that of the Air-balloon towards its end, must be noticed as having especially concurred in the universal propagation of such a conception; the one by its potent actual results, the other by the bold but legitimate hopes it was calculated everywhere to awaken.

The industrial movement became at last the per-

manent object of European policy, which everywhere placed the military at its service. Its social rise becoming more and more preponderant, was thus unable to advance otherwise than by the final accession of a corresponding political system.

SECTION X.

ÆSTHETIC, SCIENTIFIC, AND PHILOSOPHIC EVOLUTION.

It remains now to estimate the triple intellectual movement, Æsthetic, Scientific, and Philosophical, which simultaneously prepared a spiritual reorganization capable of furnishing a rational basis for the temporal reorganization, the preparation for which we have just been examining.

The Æsthetic evolution manifested itself in the middle ages as soon as society could allow of its doing so; that is to say, as soon as the Catholic and feudal organization had sufficiently developed its proper constitution. The universal adoption of Chivalry naturally marks the initial epoch, by the new excitement which resulted therefrom; but it is to the Crusades that we must trace its principal development, directly nourished during two centuries by this noble collective impulse of European energy.

The Æsthetic development was for a long time retarded by a slow and difficult preliminary operation, the indispensable accomplishment of which necessarily preceded any direct flight of poetical genius. We allude to the elaboration of modern languages, in which we may see a primary universal intervention of the æsthetic faculty. Essentially destined to the universal and energetic representation of thoughts and feelings inherent in real and ordinary life, the æsthetic genius could never properly express itself in a dead or even in a foreign lan-

guage, whatever exceptional facility it might have acquired by artificial habits.

We can readily comprehend how this special activity must have been employed during so long a time in the Middle Ages in accelerating and regulating the spontaneous formation of the modern languages. This spontaneity is not less marked in the originality of its productions, and in their artless conformity with the corresponding social situation, than in the independence of its ethics and freedom from servile imitation. We may particularly remark at this period the rough draught of a species of composition essentially unknown to the ancients, because it has a special reference to private life, so little developed among them. This sort of domestic epic, destined in later times to make such extraordinary progress, and which constitutes certainly the kind of production best suited to the true nature of modern civilization, took its rise evidently in this initial evolution.

The intimate mutual affinity shown by modern history to have existed between Æsthetic and Industrial progress, has its principle in the twofold tendency of the industrial evolution to develope spontaneously, even in the lowest classes, habits of mental activity, without which the action of the fine arts cannot be understood, and at the same time to afford the ease and security which alone can dispose to the enjoyment of such pleasures. As long as slavery and war were the characteristics of social economy, the fine arts could never acquire any great popularity, nor indeed be generally relished even among free men, except by those of the higher classes.

It is clear, on the contrary, that the industrial evolution peculiar to the end of the Middle Ages consolidated the salutary influence of the Catholic and feudal manners, by its tendency to pervade all classes; even the most humble, with the elementary dis-

positions most favourable to the action of the fine arts, whose productions would henceforward address themselves to a public at once more numerous and better prepared for their reception.

Could the Catholic and feudal system have continued, there is no doubt that the Æsthetic spirit of the 12th and 13th centuries would have acquired by its homogeneity an importance and a depth very superior to any that could have existed since, especially with regard to its popular efficiency, the true criterion of art. During the rapid and often violent transitions which were to be accomplished in the course of the great revolutionary period, and to which the industrial progression so greatly contributed, the æsthetic genius was deprived of any general direction or social destination.

The march of the Æsthetic as well as of the Industrial element was by turns spontaneous during this first-mentioned phase; stimulated during the second as a means of influence by systematic encouragement; and lastly erected, under the third, into a partial object of modern policy. Although fatal to the proper development of Art, this last phase was nevertheless necessary to finish, in the social point of view, the preparatory evolution of the new element thus directly incorporated, for the future, in the great political movement of modern society, with which it could not have been otherwise associated.

The equivocal class of "men of letters," produced by this transformation, and unhappily from that time invested with the supreme mental direction of social changes, tends spontaneously to postpone the final regeneration of society by its natural inclination to prolong the reign of the critical spirit, which can alone maintain the social preponderance of the class. The Æsthetic evolution has then arrived gradually at a point at which it can receive no new developments,

but by the universal reorganization, as we have already recognized to be the case with the industrial evolution, the principal basis of our actual social state.

We must now proceed to an equivalent demonstration of the strictly Scientific, and afterwards to the purely Philosophical evolution, in as far as they can be distinguished provisionally, one from the other. In this transient separation of the two progressions which by their common nature must certainly be at last irrevocably merged in one, we must first examine the scientific movement, without which the philosophical movement would be unintelligible.

We have already seen how favourable the passage from Polytheism to Monotheism must have been both to the development of the scientific spirit, and to its habitual influence over the common system of human opinions. Such was the transitory nature of the monotheistic philosophy, the extreme phase of theological philosophy, that far from interdicting, like Polytheism, the special study of Nature, it began by patronizing the universal contemplation of its marvels in order to the more perfect appreciation of providential optimism.

Accordingly, in the second phase of the Middle Ages, as soon as the new social state began to acquire some consistency, the memorable efforts of Charlemagne and afterwards of Alfred to revivify and diffuse the culture of the sciences bear witness to the constant solicitude of the Popes for the preservatiou of the knowledge already existing, accompanied with some secondary ameliorations.

At the same time we must admit, that, owing to the deep political pre-occupations, both spiritual and temporal, belonging to the second period of the middle ages, the principal advances in science could not be directed by *Catholic* monotheism, at that time absorbed

by far more important cares, but by the Arabian monotheism, which was eminently fitted for the work during these three centuries, under whose ascendancy so many useful ameliorations in ancient mathematical and astronomical science were introduced.

The universal accession of Scholasticism established very soon the decisive ascendancy of the metaphysical over the strictly theological spirit. The sanctity attached from that time to the authority of Aristotle is a sign of this memorable transformation.

The harmony of this new intellectual development with the general situation of active minds is characterized in the most decisive manner by the continued avidity with which thousands of hearers flocked to the teachers in the great European Universities during the last phase of the middle ages.

Let us now make a rapid examination of this important progress during the three successive phases which we have marked out. Under the first of these the march of science is, like that of art and that of industry, essentially spontaneous, without any important interference of the special encouragement afterwards organized. In scientific as in æsthetic progress the second phase constitutes certainly the most decisive period of its modern evolution, especially on account of the movements which, from Copernicus to Newton, laid the definitive foundations of the true system of astronomical science, now become the fundamental type of Natural Philosophy.

During the third phase the scientific element receives an important increase of social power, exactly analogous to that which we have pointed out with regard to the æsthetic element, and perhaps even yet more strongly characterized on account of its more evidently progressive nature. The increasing relations of natural and organic philosophy both with military affairs and with the industrial movement, as the principal objects of

European policy, determine at this epoch a great extension in the social influence of the sciences.

We will now consider the philosophical evolution, as distinguished provisionally from the purely scientific. Scholasticism had realized to its utmost the social triumph of the metaphysical spirit, the profound impotence of which was unrecognized during several ages, from its incorporation with the Catholic constitution. By accepting thus the dangerous appeal to Reason, the monotheistic faith departed in an irrevocable manner from its original nature. This strange combination, by which an attempt was made to conciliate the theological with the positive spirit, bears the characteristic impress of the metaphysical spirit which had conceived it, and which had evidently reserved for itself the best share, by making Nature an object of daily contemplation and even adoration, leaving only a sterile veneration for the majestic inertness of the supreme Divinity, solemnly reduced to a vague *initial* intervention! This scholastic compromise constituted, in fact, a profoundly contradictory situation, the stability of which was impossible.

Under the second phase the metaphysical philosophy was in possession of the spiritual authority it had always coveted, even among the nations which had nominally remained Catholic; and at the same time the scientific spirit began to display itself in its true character by the gradual convergence of its spontaneous elaboration towards decisive discoveries; a character entirely incompatible with the ancient philosophy, metaphysical as well as theological.

Germany had already, in the preceding century, reached this decisive crisis, both by the movement of religious reformation, and still more by the grand astronomical discoveries of Copernicus, Tycho Brahe, and lastly of the great Kepler. But absorbed in religious contests it could give no active concurrence. England,

Italy, and France, on the contrary, furnished each an eminent co-operator in this noble elaboration: three philosophers, whose genius though very different was equally indispensable,—Bacon, Galileo, and Descartes, who will be acknowledged by all posterity as the first founders of the Positive Philosophy.

The third phase could be nothing but a simple extension of the one preceding. The only conception which we can regard as really belonging to it consists in the grand idea of human *progress*, which even under the ascendancy of the negative elaboration prepared the principle of mental reorganization. The illustrious economist, Turgot, was led to his celebrated theory of indefinite perfectibility, which in spite of its metaphysical character served afterwards as the basis of the grand historical project conceived by Condorcet, under the inspiration of the revolutionary crisis.

It is impossible not to remark that the entire evolution of modern philosophy constitutes merely *a preliminary elaboration*, the essence of which resides in a plan for human regeneration. Hence in this work I have made a distinct separation between the Preliminary Sciences, and the one Final Science which is to form the basis of social reorganization.

Such is the general result of our historical survey: in the great European republic, the impulse of new social elements constituted an universal movement of partial recomposition, destined to concur with the simultaneous movement of political decomposition, in order to evolve from their inevitable combination the final regeneration of mankind.

These two simultaneous movements of political decomposition and social reorganization, whose convergence gave its characteristic to modern society from the 14th century, could not, in spite of their intimate connection, be accomplished with the same rapidity; so that towards the end of our third phase the

negative progression was already sufficiently advanced to prove distinctly the imminent need of a final reorganization, whilst the imperfection of the *positive progression* hindered the true nature of such a regeneration from being adequately conceived. This unavoidable disparity is the real cause of the vicious direction pursued by the revolutionary crisis in which this twofold universal movement was to end.

But if it had not been for this salutary explosion of the French Revolution, unveiling at last to all eyes the chronic decomposition of which it was the result, the powerless caducity of the ancient system would have remained profoundly hidden, so as radically to fetter the political march of the select few, by concealing all ideas of any real reorganization, which would have appeared superfluous to the vulgar: so disposed is our feeble intelligence to content itself with the slightest organic outward appearances, to exempt itself from the troublesome efforts necessary to the conception of a new order of things. This decisive crisis was indispensable to indicate to all the advanced nations the advent of the final regeneration gradually prepared by the great movement of the five preceding centuries.

This great outbreak, clearly presaged by the general state of things, had been specially announced about the end of the third phase by three events of different natures and unequal importance, but all, in this respect, equally significant. The first and most decisive was assuredly the abolition of the Jesuits. Nothing could more strongly mark the irrevocable caducity of the ancient social system than this blind destruction of the only power capable to a certain extent of retarding its imminent decline. The second precursory symptom resulted, shortly after the first, from the great attempt at reform vainly made under the celebrated administration of Turgot, the inevitable failure of which brought

into view the absolute necessity of more extensive and radical innovations, especially that of an energetic popular protest against the abuses inherent in a retrograde policy. Lastly, the famous American Revolution furnished an occasion for the spontaneous expression of the universal disposition of the French for a decisive change.

SECTION XI.

THE FRENCH REVOLUTION.

In order to appreciate what was accomplished by the French Revolution, we must consider it under two aspects,—the one simply *preparatory*, the other entirely *characteristic*, under the respective conduct of the two great National Assemblies.

In the preparatory period, the need of regeneration, as yet only vaguely felt, appears reconcileable with a certain indefinite conservation of the old régime, disengaged as much as possible from all its parasitical abuses. The Constitutional metaphysicians meditated at that time an indissoluble union of the monarchical principle with popular ascendancy, as well as that of the Catholic Institution with mental emancipation. Such was in fact the political Utopia of the principal leaders of the Constituent Assembly.

In the second revolutionary period we see the true instinct of the social crisis realizing itself in a definite shape. Justly opposed to the political fictions upon which the incoherent edifice of the Constituent Assembly rested, the Assembly, immortalized under the name of *The National Convention*, was led by its very origin to regard the entire abolition of the monarchy as an indispensable prelude to that social regeneration towards which the Revolution directly tended. This abolition, without which the French Revolution would not have been fully characterized, was soon to be followed by

partial demolitions destined to complete the indication of an irresistible tendency to an entire renovation of the social system, as far as the only philosophy which could at that time direct this activity permitted.

After the fall of the Convention, a retrograde action made itself immediately felt by the vain return to constitutional metaphysics peculiar to the first period of the crisis, the barren obstinacy of which tended always to reproduce, as far as the general state of the public mind permitted, a blind imitation of the English Constitution, characterized by a chimerical balance of the different fractions of the temporal power.

Such a political fluctuation perpetually threatening the existence of Order, and yet barren of progressive results, ended, in spite of energetic popular protests, in the passing triumph of the retrograde system. It was certainly impossible that such a situation should lead to anything but a genuine military dictatorship. From the radical contradiction necessarily existing between the elevation of Bonaparte and the monarchical spirit which he endeavoured to restore, the political habits contracted under his influence were certain to facilitate spontaneously, after his fall, the temporary return of the natural heirs of the ancient French monarchy.

It will naturally suggest itself to the reader that France has again acted that drama of Revolution, on a smaller stage and with far inferior actors; the corrupt Monarchy of July being replaced by the vague Republic of February, which, after having practically demonstrated its metaphysical incompetence, resulted in the Dictatorship of December.

In this strange provisionary situation, consider the result of the implicit renunciation by those in office of any serious notion of a mental reorganization, their unfitness for which was recognized by themselves. Now this incompetence, tacitly confessed, necessarily sur-

renders the intellectual and moral power to whomsoever can and will seize it: hence the peculiar ascendancy of Journalism as a lay pulpit.

The extreme imperfection of this power ought not to prevent our acknowledging the great importance of its advent. Regarded historically, this new preponderance, which must certainly increase, is a decisive symptom of the power which the instinct of spiritual reorganization has acquired now-a-days in the Revolutionary School.

Considering the actual progress of political recomposition relatively to the temporal organization, it is easy to recognize that in spite of the exceptional development of a prodigious martial activity, the gradual course of the revolutionary crisis concured not less than that of the theological system itself, in completing a general decline of the military system. The very nature of the revolutionary war put an end to the last series of systematic wars, tending to perpetuate military activity by making use of it in the interests of industrial activity. It is thus that the last general source of modern wars disappeared throughout the European republic.

The modern institution of recruiting by force is evidence of the anti-military disposition shown by the people of modern times; we still find genuine volunteers among the officers, but few, or none, among the privates. At the same time it tends to destroy military habits and ardour, by putting an end to the primitive speciality of the profession, and by composing armies of a mass radically antipathetic to a military life, which to them is merely a temporary burden.

The recourse to such an expedient marks the final decadence of the military system, henceforward reduced to a subaltern though indispensable office in the mechanism of modern society. The vast military apparatus preserved amongst all the European nations, would, at first sight, appear to announce the imminence of a contrary disposition, did not a more searching in-

vestigation of the situation explain this apparent anomaly by referring it directly to the common requirements of the revolutionary crisis, more or less spread over the whole western republic.

In a state of profound intellectual and moral disorder, which must always render a material anarchy imminent, the means of repression must acquire an intensity corresponding to that of the insurrectional tendencies, so that an indispensable degree of Order should protect true social Progress against the continuous efforts of ill-directed ambition united with vicious conceptions.

Thus we see the same epoch which is destined to witness the final disappearance of war, in the proper acceptation of the word, has also developed a new social mission in Armies, of extreme importance, by converting them into a vast political constabulary. Standing Armies are now no longer instituted in defence of the country against other nations, so much as in preservation of Order at home.

It is easy to see how much the social preponderance of the industrial element would be augmented and consolidated by a revolutionary crisis which completed the secular destruction of the ancient hierarchy, and which placed foremost the temporal rank founded upon riches, the influence of which has become evidently inordinate from the existing intellectual and moral anarchy.

The most unquestionable and the most dangerous of the recent aggravations of the vices inherent in the industrial movement, consists in the increased opposition established between the respective interests of capitalist and workman. This deplorable antagonism shows how far Industry is essentially from any genuine organization, since no progress can be accomplished without its tending to become oppressive to the greater part of those whose co-operation is most indispensable to it.

The remarks already made upon the general character of the æsthetic evolution during the third modern phase, exempt us from the necessity of any observations on the last half century, which displays important modifications. The same holds good with regard to the scientific and philosophical evolution.

SECTION XII.

THE FUTURE.

This historical appreciation, which completes our brief examination of the Past, leads us to consider the present time as the epoch in which the grand philosophical renovation projected by Bacon and Descartes is to determine the spiritual reorganization of modern society, destined afterwards to preside over the political regeneration of mankind.

Guided by his logical principles of the general extension of the Positive Method to the rational study of social phenomena, Comte has gradually applied to the whole of the past his fundamental law of the evolution at once mental and social, consisting in the passage of Humanity through three successive states: the preparatory Theological state, the transitory Metaphysical state, and the final Positive state. By the aid of this single law he has explained all the great historical phases, considered as the principal consecutive phases of development, so as rightly to appreciate the true character proper to each of them, with the natural emanation of one phase from the preceding, and its tendency towards the following phase: whence results the conception of a homogeneous and continuous connection in the whole series of anterior ages, from the first manifestation of sociality, to the most advanced condition of mankind.

A law which has sufficed to fulfil adequately these

conditions is no mere philosophical fancy, but must contain an abstract expression of the reality. It can be employed with rational security in connecting the future with the past. The foremost portion of mankind, after having exhausted the successive phases of Theological life, and even the different degrees of metaphysical transition, is now approaching the completely positive state, the principal elements of which have already sufficiently received their partial elaboration, and now only await their general co-ordination to constitute a new social system.

This co-ordination must be first intellectual, then moral, and lastly, political. Every attempt rising from any other logical source would be utterly powerless against the present state of disorder which is essentially mental. As long as this disorder remains, no durable institution can be possible, for want of a solid basis; and our social condition will admit of only provisionary political measures, destined for the most part to guarantee the maintenance of a degree of material Order against ambitions everywhere excited by the gradual diffusion and extension of spiritual anarchy. To fulfil this office, all governments, whatever be their form, will continue necessarily to count as they do upon nothing but a vast system of corruption, assisted, on occasions of necessity, by a repressive force.

Nothing of what is at present classed is capable of being directly incorporated in the final system, all the elements of which must previously undergo an entire intellectual and moral regeneration: thus the future spiritual power, the first basis of a genuine reorganization, will reside in an entirely new class, having no analogy with any of those now existing, and originally composed of members issuing indifferently, according to their peculiar individual vocation, from all ranks of society; the gradual arrival at this salutary incorporation will be also essentially spontaneous, since its social

ascendancy can result only from the voluntary assents of all intelligences to the new doctrines successively worked out: so that by its nature such an authority could neither be decreed nor interdicted.

As we have recognized in principle that the evolution of mankind is characterized by a perpetually increasing *influence* of the speculative over the active life, although the latter will always preserve the *actual* ascendancy, it would be contradictory to suppose that the contemplative part of man will remain for ever deprived of proper cultivation and distinct direction in a social state in which intelligence will have the most habitual exercise, even among the lowest classes.

At a time when all thinking minds admit the necessity of a permanent division between theory and practice, for the simultaneous perfecting of both, in the least important subjects to which our efforts are directed, can we hesitate to extend this healthy principle to the most difficult and most important operations, when such a progress has become sufficiently realizable? Now, under the purely mental aspect, the separation of the two powers, spiritual and temporal, is in fact the mere exterior manifestation of the same distinction between science and art, transferred to social ideas, and made systematic.

While spiritual reorganization is the most urgent, it is also, in spite of the great difficulties attending it, the best prepared amongst the most advanced minds. On one hand, existing governments renouncing the task of directing such an operation, tend thereby to confer this high office upon that philosophical system which shall prove worthy of presiding over it. On the other hand, the populations radically freed from metaphysical illusions by the teaching of half a century of decisive experiments, begin to understand that all the social progress compatible with current doctrines has been accomplished, and that no important political institution

can now arise which is not based upon an entirely new philosophy.

The general principle which determines the separation between the respective attributes of spiritual and temporal power consists in considering the spiritual authority as *decisive* in all that concerns education, whether special or general, and merely *deliberative* in all that concerns action, whether private or public, its habitual interference being only to recall in every case the rules of conduct previously established. The temporal authority, on the contrary, entirely absolute as far as regards action, to the extent of being able, under responsibility as to results, to follow a line of conduct opposed to the corresponding authority, cannot exercise more than a simple *deliberative* influence over education, being limited to solicit the revision or partial modification of the precepts apparently condemned by practice.

It is principally as a general basis to such a system that the Positive Philosophy must be previously coordinated and established, destined as it is to furnish henceforward to the human mind a resting-place, by means of a homogeneous and hierarchical series of positive ideas, at once logical and scientific, upon all orders of phenomena, from the lowest to the most eminent moral and social phenomena.

Positive education will be principally characterized by the final systematization of human ethics, which, freed from all theological conceptions, will rest on positive philosophy. The indefinite dispersion of religious creeds left to individuals will prevent anything being established on such insecure foundations. What philosophical inconsistency can be compared to that of our deists, whose dream is now the consecration of morality, by a religion without a revelation, without a worship, and without a clergy?

Humanity must be looked upon as still in a state of

infancy, as long as its principal rules of conduct, instead of being drawn from a just appreciation of its own nature, shall continue to rest upon extraneous fictions. Such is the general aim, nature, and character of the spiritual reorganization which must necessarily commence and direct the entire regeneration, towards which we have seen the permanent course of all the different social movements, since the middle ages, more or less directly converge.

As to the temporal reorganization, we will confine ourselves to the general principle of the elementary coordination of modern society.

In proceeding to do this, we must set aside the distinction between the two sorts of functions, *public* and *private*. In every truly constituted social body, each member may, and ought to be, considered as a public functionary, inasmuch as his particular activity concurs with the general economy.

The dignity which still animates the most obscure soldier in the exercise of his humblest duties, is certainly not peculiar to the military order; it belongs equally to everything that is systematic; it will one day ennoble the simplest profession, when Positive Education, causing a just general notion of modern sociality to prevail everywhere, shall have made it sufficiently understood by all, that each partial activity has a continuous participation in the common economy. Thus the general cessation of the division now existing between private and public professions, depends necessarily upon the universal regeneration of modern ideas and manners.

Although this final elevation of private professions to the dignity of public functions will certainly make no essential change in the existing mode of exercising them, it will entirely transform their general spirit, and probably have a considerable effect upon their usual conditions. Whilst on the one hand such a normal

appreciation will develope in all classes a noble personal feeling of their social value, it will on the other hand make evident the permanent necessity of a certain systematic discipline, tending to guarantee the preliminary and continuous obligations proper to every career. In one word, this simple change will constitute spontaneously an universal symptom of regeneration.

In every society, whatever be its nature and destination, each different partial activity becomes classed according to the degree of generality which distinguishes its habitual character. Consequently the real philosophical difficulty in this matter consists in the true appreciation of the different degrees of generality inherent in the different functions of the positive organism.

Now this has already been almost entirely accomplished, although with another intention. Social progress, in fact, first presented itself to us as a sort of necessary prolongation of the animal series, in which beings are the more elevated the nearer they approach to the human type; whilst, on the other hand, the human evolution is especially characterized by its constant tendency to make those essential attributes predominant which distinguish man from the animal. Such is the first basis which positive philosophy will naturally furnish to social classification.

The first application of this hierarchical theory to the new social economy leads us to conceive the *speculative* class as superior to the *active* class, since the first affords a wider field for the exercise of the faculties of generalization and abstraction which form the great distinction of human nature. For this purpose, however, it is first necessary that the members of this speculative class should be sufficiently freed from that *speciality* in their studies and ideas, which we have seen to be a decided obstacle to the elaboration of a

Philosophy, although originally indispensable as a division of labour.

The speculative class separates itself into two distinct parts, according to the two very different directions taken by the contemplative spirit, sometimes philosophical or scientific, sometimes æsthetic or poetical. Whatever the social importance of the Fine Arts, it is unquestionable that the æsthetic point of view is less abstract and less general than the philosophical or æsthetic. The latter has immediate relation to the fundamental conceptions destined to direct the universal exercise of human reason, whereas the other merely relates to the faculty of expression, which can never occupy the first rank in our mental system.

The active or practical class, which necessarily embraces an immense majority in its more distinct and complete development, has already made its essential divisions appreciable: so that with respect to them the hierarchical theory has only to systematize the distinctions hitherto consecrated by use. To this end we must consider first the principal division of industrial activity into *production*, properly so called, and the *transmission of products*. The second is evidently superior to the first, as regards the abstract nature of its operations, and the generality of its relations.

After dividing the active or practical class into two principal categories, one of which confines itself to production, while the other employs itself in the transmission of products, Comte again subdivides each of these into two, according as the production is that of *simple materials*, or their *direct employment*, and as the transmission refers to the *products themselves* or merely to their *representative signs*. It is plain that of these two divisions the last has a more general and abstract character than the preceding one, conformably to our established rule of classification. These two divisions constitute the real industrial hierarchy: placing in the

highest rank the Bankers, by reason of the superior generality and abstract nature of their operations; next the Merchants, then the Manufacturers, and lastly the Agriculturists, whose labours are necessarily more concrete, and whose relations are more restricted than those of the other three practical classes.

By an easy combination of the preceding indications every one may form a conception of the positive economy. The normal classification resulting from it will be naturally consolidated by its homogeneity: since in this hierarchy no class can refuse to recognize the superior dignity of the preceding one, except by immediately altering his own position towards the one following, the uniformity of the principle of co-ordination being constant. The same hierarchical principle extended to domestic life, comprises the true law of the subordination of the sexes.

By imposing moral obligations, more extensive and more strict in proportion as social influences become more general, the fundamental education will directly tend also to the abuses inherent in these necessary inequalities. It is clear, too, that these different elementary tendencies of the new economy cannot obtain their social efficacy until a system of universal education shall have sufficiently developed the attributes and manners which must distinguish these different classes, and of which we can form no idea in the present confused state of things.

Considered with regard to the degrees of material preponderance, henceforward measurable principally by wealth, our statical series presents necessarily opposite results according as we examine the speculative or the active class: for in the former the preponderance diminishes, while in the latter it augments, as we ascend in the hierarchy. If, for example, the first cooperation, even in a purely industrial point of view, of the grand astronomical discoveries which have brought material

arts to their present perfection, could be duly appreciated in every expedition, it is evident that no existing fortune could give any idea of the monstrous accumulation of riches which would thus have been realized by the temporal heirs of a Kepler, a Newton, &c., even if their partial remuneration were fixed at the lowest rate. Nothing can serve better than such hypotheses to demonstrate the absurdity of the pretended principle relative to an uniformly pecuniary remuneration for all real services; proving as they do that the most extensive usefulness, inasmuch as it is too distant and too much diffused in consequence of its superior generality, can never find its just recompense except in the higher social consideration it enjoys.

From these remarks it is clear that the principal pecuniary ascendancy will reside in about the middle of the entire hierarchy, in the class of bankers, naturally placed at the head of the industrial movement, and whose ordinary operations have precisely the degree of generality most proper for the accumulation of capital. Here it is that we shall find the principal ultimate seat of temporal power, properly so called. We must remark also, on this subject, that this class will always be by its nature the least numerous of the industrial classes; for in general the positive hierarchy will necessarily present an increasing numerical extension in proportion as its labours becoming more special and more urgent, admit and require at once more multifarious agents.

After this sociological summary it would surely be superfluous to add any direct explanation of the necessarily mobile composition of the various classes making up the positive hierarchy. Universal education is eminently fitted in this respect, without exciting any disturbing ambitions, to place every one in the situation most suitable to his principal aptitudes, in whatever rank he may have been born. This happy influence, far more dependent by its nature upon public opinion

than upon political institutions, demands two opposite conditions both equally indispensable, the fulfilment of which will in no wise assail the essential basis of the general economy. On the one hand it is necessary that the access to every social career should remain constantly open to just individual pretensions, and that nevertheless, on the other hand, the exclusion of the unworthy should be always practicable according to the common appreciation of the normal guarantees, both intellectual and moral, which the fundamental education will have prescribed for every important case.

Doubtless after the present existing confusion shall have terminated in some primary regular classification, such changes, although always possible, will become essentially exceptional, being considerably neutralized by the natural tendency to hereditary professions: for the greater number of men have in reality no special vocation, and at the same time the greater number of the social functions require none; which will naturally leave a great habitual efficacy to imitation, except in the very rare cases of a real predisposition.

It would besides be evidently chimerical to dread the ultimate transformation of classes into castes, in an economy entirely free from the theological principle: for it is clear that castes could never have any solid existence without a religious consecration. Puerile terror on this score must not be made the occasion or pretext for an indefinite opposition to every true social classification, when the preponderance of the positive spirit, always in its nature accessible to a wide discussion, will be able to dissipate the anxieties raised by the vague and absolute character of theologico-metaphysical conceptions.

Let us now consider the great spiritual reorganization of modern society, pointing out its intimate connection with the just social reclamations of the lower classes. Every spiritual power should be essentially popular,

since its most extended sphere of duty relates to the constant protection of the most numerous classes, habitually the most exposed to oppression, and with which the education common to all leads it into daily contact. In the final state the spiritual class will be connected with the popular mass by common sympathies, consequent upon a certain similitude of situation, and parallel habits of material improvidence, as well as by analogous interests with regard to the temporal chiefs, necessarily possessors of the principal wealth.

But we must especially remark the extreme popular efficacy of speculative authority, whether by reason of its office of universal education, or because of the regular interference which, according to our previous indications, it will always exercise in the different conflicts of society: thereby developing suitably the mediatory influence habitually attendant on the elevation of its views, and the generosity of its inclinations. Narrow views and malignant passions will in vain attempt to institute legally laborious hindrances against the accumulation of capital, at the risk of paralyzing directly all real social activity. It is clear that these tyrannical proceedings will have much less real efficacy than the universal reprobation applied by the positive ethics to any utterly selfish use of the wealth possessed.

When the new speculative class shall have arisen, the great practical collisions continually becoming more numerous in the total absence of any industrial systematization, will doubtless constitute the principal occasions of its social development, by making apparent to all classes the increasing utility of its active moral intervention, alone capable of sufficiently tempering material antagonism, and of habitually modifying the opposing sentiments of envy and disdain inspired on either hand. The classes most disposed at present to

recognize the real ascendancy which wealth enjoys, will then be led by decisive and probably melancholy experience to implore the necessary protection of that very spiritual power which they now look upon as essentially chimerical.

It is in this manner that a power which by its nature can rest on no other foundation than that of its universal free recognition, will be gradually established on the ground of the services rendered by it. The popular point of view is henceforward the only one which can spontaneously offer at once sufficient grandeur and distinctness to be able to place the minds of men in a truly organic direction.

The unavailing changes of individuals, ministerial or even royal, which appear of so much importance to the various present factions, will naturally become quite indifferent to the people, whose own social interests can in no wise be affected thereby.

The assurance of education and work to every one will always constitute the sole essential object of popular policy properly so called: now this great end, perfectly separated from constitutional discussions and combinations, can never be adequately attained but by a real reorganization; first and foremost spiritual; afterwards necessarily temporal.

Such is the connection which the entire situation of modern society institutes between popular necessities and philosophical tendencies, and according to which the true social point of view will gradually prevail in proportion as the active intervention of the People, speaking in their name, begins to characterize more and more the grand political problem.

CONCLUSION.

We have now passed rapidly through the sciences of which Comte has given the philosophy in the six volumes of his *Cours de Philosophie Positive.* This is the real and lasting service he has done to Humanity. Respecting his attempts to reorganize society on the basis he lays down, I, for one, deem them premature; but this is not the place to enter upon so vast a subject. The curious reader is advised to settle that question for himself, by a careful study of the *Politique Positive* now in course of publication. A few paragraphs, in the way of analysis, is all that can be ventured on here.

He begins with Religion, as the key-stone of the social arch; the bond which binds the divergent tendencies of human beings into unity, and which *binds together (religare)* the diverse individualities into Society. Religion, which at first was spontaneous, next inspired, then revealed, now in this final state becomes *demonstrated:* following thus the laws of evolution which have presided over Science. Religion, as defined by Comte, is not this or that form of creed, but the harmony proper to human existence, individual and collective, constituting for the soul a normal *consensus* similar to that of health for the body. It gathers into its bosom all the tendencies of our nature, active, affectionate, and intelligent. It presides over Politics, Art, and Philosophy.

Every stage of Religion demands the continuous con-

course of two spontaneous influences: the one objective and essentially intellectual, the other subjective and purely moral. On the one hand, our intelligence must conceive an external Power to which our existence must be subordinated. On the other, it is equally indispensable that we should be animated by an internal affection capable of binding together all the other affections. Submission to the external power naturally seconds this internal discipline. Men in our day almost universally consider Unity as resulting only from our moral condition; but, in truth, no unity would be possible without this objective dependence. When the belief in an external power is incomplete or vacillating, the purest moral sentiments are incapable of preventing "*d'immenses divagations et de profondes dissidences.*"

To fulfil its true function (*pour nous régler et nous rallier*), Religion must therefore first subordinate our existence to an external and irresistible Power. This social dogma is, properly speaking, no more than the development of the biological notion of the necessary subordination of an organism to a medium. Religion rests on the permanent combination of two conditions—Love and Faith; and its "*véritable unité consiste à lier le dedans et le relier au dehors.*" Since, then, it concerns at once both the heart and the mind, it naturally divides itself into two parts, one intellectual, the other moral; the first constitutes the *credo*, properly so called, and consists in determining that external order to which we are necessarily subordinate. And here it is that the capital distinction must be sought between the Positive Religion and all other religions. It is, as before stated, a religion of demonstration. Its *credo* comes from the demonstrated truths of Positive Science, and the striving of science has resulted in furnishing precise and coherent views of physical phenomena, and thus furnishing a basis to religion.

Hitherto, in spite of their decrepitude, intellectually

speaking, the earlier religions have maintained their supremacy by reason of moral considerations. To Science has been handed over all explanation of physical laws; but moral laws have been reserved for other teachers. Comte claims to have made the two one, by his foundation of social science. The gradual appreciation of the fundamental order reveals to us a final class of natural laws more hidden and more complicated than the former, but also more nearly concerning us. Although the course of our existence is directly subordinated to cosmical and biological laws, it is not wholly represented by them. Our principal functions demand another explanation. We all feel ourselves ruled over by chemical, astronomical, and vital laws. But on a closer inspection we find there is another yoke, not less irresistible though more modifiable, resulting from the statical and dynamical laws proper to the Social order. Like all the others, this fatality makes itself sensible, first by its physical results, next by its intellectual influence, and finally by its moral supremacy. Since the dawn of civilization every one has felt that his destiny was materially bound to that of his contemporaries, and even his predecessors. Later on, the involuntary comparison of various social conditions manifests the intellectual dependence of each upon the rest. The proudest dreamer cannot misconceive the great influence exercised over individual opinions by time and place. And finally, as regards the most spontaneous phenomena, examination detects the dependence of our own moral condition on that of the general character of the corresponding sociability. Thus, under all aspects, man feels himself subject to Humanity.

Humanity is thus the great Collective Life of which human beings are the individuals; it must be conceived as having an existence apart from human beings, just as we conceive each human being to have an existence apart from, though dependent on, the individual cells of

which his organism is composed. This Collective Life is in Comte's system the *Etre Suprême;* the only one we can *know,* therefore the only one we can worship.

Indisposed as I am to occupy any of the few remaining pages with criticism, I cannot forbear from pointing out one immense omission in the foregoing system. It makes Religion purely and simply what has hitherto been designated Morals. In thus limiting Religion to the relations in which we stand towards one another and towards Humanity, Comte leaves an important element aside; for, even upon his own showing, Humanity can only be the Supreme Being of *our* world—it cannot be the Supreme Being of the Universe. To limit the Universe to our planet is to take a rustic untravelled view of this great subject. If, in this our terrestrial sojourn, all we can distinctly *know* must be limited to the sphere of one planet, nevertheless even here, we, standing on this ball of earth and looking into the infinitude of which we know it to be but an atom, must irresistibly feel and know that the Humanity worshipped *here* cannot extend its dominion *there.* I say, therefore, that supposing our relations towards Humanity may one day be systematized into a distinct *cultus,* and made a Religion, and supposing further our whole practical priesthood to be limited to it, there must still remain for us, outlying this terrestrial sphere, the other sphere named Infinite, into which our eager and aspiring thoughts *will* wander, carrying with them, as ever, the obedient emotions of love and awe. So that beside the Religion of Humanity, there must be a Religion of the Universe; beside the conception of Humanity, we need the conception of a God as the Infinite Life, from whom the Universe proceeds, not in alien indifference—not in estranged subjection—but in the fulness of abounding Power, as the incarnation of resistless Activity! In plainer language, there must ever remain the old distinction between Religion and Morality—between our

relations to God and our relations to Man; the only difference between the old and the new being that in the old theology moral precepts were inculcated with a view to a celestial habitat; in the new they will be inculcated with a view to the general progress and happiness of the race.

To resume our analysis of the *Politique Positive*. After treating of Religion—which he does with considerable detail—he presents his theory of Property. This *question brûlante* is one which Socialist writers in general have treated very inconsiderately, not to say absurdly. "*La Propriété c'est le vol*" was, it may be, only a pistol fired in the air; but the experience of revolutions teaches us the terrible consequences of a pistol fired in the air. As far as the social argument was concerned, the question of Property was purely one of *Distribution*, not of *Origin*. It was thought that another mode of distribution would be more effective, more equitable, more economical. By perplexing this question with one of "Rights" of "possession," the egotistic fears and prejudices of all possessors were aroused, and instead of discussion there was combat, instead of argument invective on *both* sides.

Comte, as a philosophic socialist, who founds his theories upon actualities, who leaves to others the pleasant fields of Utopia, and is content to take human nature as he finds it, not only vindicates Property, but undertakes to show its essential position in social order. He includes it in the whole material and industrial activity of man, and shows how the institution of capital becomes the necessary basis of that division of labour which Aristotle declared to be the principal practical characteristic of social harmony; and by thus permitting the division of labour, capital impels every active citizen to work not only for himself, *but for others*.

The peculiarity of Comte's system is its deduction of social principles from biological principles; and in this

great question of property he does not discuss alone the economical side, but shows how here, as elsewhere, the selfish instincts of man lead in their satisfaction to the development of unselfish instincts,—how *egoism* is the impulse to *altruism*: thus the egoistic instinct of material preservation, which impels to industry, is the foundation of Society, rendering it possible in a higher sense than that of mere aggregation of families.

The same luminous method of deducing the social from the individual is seen in the next chapter, which treats of "The Family" both as a moral and as a political basis, where we see clearly public social virtues arising out of private personal feelings. Comte is very energetic in his denouncement of what he considers the anarchial theories of "female emancipation." Considering "woman's mission" to be strictly and simply the office of Sentiment, in tempering, refining, and rendering more social the essential practical Activity of man—viewing woman as the symbol of Affection, as man is of Force, he holds that, so far from women performing the same work as men, they ought not to work at all, except in their domestic sphere. The man is bound to work for the woman's support; and she, in return, is bound to obey him implicitly. He quotes, with approbation, the saying of Aristotle, that "woman's force is best shown in surmounting the difficulty of obedience."

The fifth chapter is on Language, which he rightly conceives as analogous to Capital. It is intellectual capital; the stored-up labour of generations of minds. Its social function has never before been so closely indicated. But to bring forward the views there maintained would require considerable space; indeed, the same may be said of the whole volume, the novelty of which prevents rapid analysis, every point requiring to be placed in a light acceptable to the reader.

The third and fourth volumes, in which Social Dynamics are discussed, have not yet appeared. It is hoped that to them, and to the whole of Comte's works, a fitting introduction has been presented in the volume we now close.

INDEX.

Abstract and concrete mechanics, 71.
Æsthetic, scientific, and philosophic evolution, 313-321.
Ages of fetichism and polytheism, 273.
Aim and scope of positivism, 8.
Albumen, components of, 182.
Aliment and structure, relation between, 197.
Alleged insanity of Comte, 3.
Analogy between human and social organism, 34.
Analysis and synthesis, advantages of, 120.
Analysis of Comte's political philosophy, 339-345.
Analysis of the reflective faculty, 230.
Anarchy of politics, causes of the present, 12.
Animal and vegetative life defined, 192.
Anorganic matter, 153.
Anthropomorphic tendency of the human mind, 90.
Art and science, connection of, 165.
Ascherson's discovery of cell-formation in fat or oil, 159.
Astronomy and religion, 84, 92.
Astronomy, general considerations on, 75.
— superior to all other sciences, 81.
Astronomical phenomena, exploration of, 79.
Atheism imputed to Comte, 24.
Attempts to create a political doctrine, 243.

Bichat's definition of life, 166; his device for decomposing organism, 180.
Binary, ternary, and quaternary combinations, 143.
Biographical Introduction, 1.
Biology and chemistry, assimilation between, 134.
Biology should be separated from medicine, 166.
Birth and education of Comte, 2.
Bliss, Comte's year of, 6.
Bowman and Todd, fallacies of, 204.
Brame's discoveries in crystallization, 154.

Carpenter (Dr.) on the origin of organic life, 176.
Catalytic force, 124.
Catholicism in the middle ages, 288-299.
Celestial and terrestrial physics, 44.
Cellular tissues the basis of every organism, 185.
Cerebral theory, a new, 213.
Character of scientific conceptions considered, 250.
Chevreul on the laws of assimilation, 193.

Chemical and vital phenomena defined, 139.
Chemical nomenclature, comparative perfection of, 127.
— phenomena, considerations respecting, 115.
Chemistry and physics, distinction between, 95.
Chemistry, general considerations on, 113.
Chossat's (M.) experiments on pigeons, 195.
Classification of chemical compounds, 117.
— of the sciences, 40.
Coleridge on Bichat's definition of life, 166.
Communism opposed by positivism, 11.
Comparison the great art of biology, 175.
Compounds, classification of chemical, 117.
Comte's opinion of St. Simon, 3; rapidity of composition, 4; story of his wrongs, 4; romantic love, 6; year of happiness, 6; his introductory lecture, 14; his estimation of mathematics, 50.
Condorcet's conception of sociology, 247.
Connection between astronomy and religion, 87.
Contemplation, synthetical and analytical, 229.
Cuvier on the laws of nature, 53.
— on the comparative anatomy of an organ, 178.

De Blainville's definition of life, 171.
Definition of chemistry, 116.
Difference between physical and chemical phenomena, 96.
— between chemical and vital phenomena, 139.
Distinction between organic and animal life, 187.
Divisions of chemistry as yet imperfect, 130.
Doctrine of chemical affinities, 123.
— of positive philosophy, 9.

Education, Comte's views of, 16.
Egoism and altruism, 217.
Elementary and immediate synthesis or analysis, 146.
Embryology, one of the laws of, explained, 33.
Exercise, the laws of, in connection with animal life, 172.
Experiment little employed in biology, 175.
Exploration of astronomical phenomena, 79.
Exposition of humanity, Comte's, 35-40.
Expression and conception defined, 228.
Extent of mathematical science, 63.

Fetichism and polytheism analysed, 273-287.
Fibrine, constituents of, 182.
Fibrous, cartilaginous, and osseous tissues, 186.
Final causes, Comte on the doctrine of, 89.
French revolution (the) considered, 322-326.
Function must involve structure, 143.
Fundamental character of theological philosophy, 102.
— law of evolution, 26.

Gall's arrangement of the nobler instincts, 223.
General and special geometry, 66.
— considerations on chemistry, 118.
Geometrical and mechanical astronomy, 84.
Geometry of the ancients, 66.
—, extent of the science of, 65.

Human and social organism, analogy between, 35.
— evolution considered, 268.
— mind, the, emancipated by chemistry, 129.
Hypothesis, great utility of, 105.

Independence of astronomical phenomena, 86.
Individuality, tendency to, in polyps, 170.
Industrial order, rise of the, considered, 305.
Inert bodies, 70.
Influence and method of physics, 101.
Inorganic and organic bodies, no real distinction between, 134.
— substances definite in their composition, 150.
Instinct and intelligence, 206.
Intellectual anarchy, increase of, 243.
— evolution, three phases of, 10.
Introductory lecture of Comte, 14.
Inventions in the latter centuries of the Middle Ages, 309.
Isomerism explained, 150.

Laws of Nature—what are they? 51.
—, objections to the phrase of, 52.
Liebig's fallacy regarding the nutritive properties of gelatine, 197.
Life an impenetrable mystery, 215.

Materialism or immaterialism, 198.
Mathematics analyzed, 61.
— applied to physics, 99.
Mechanical and geometrical astronomy, 84.
Merorganic matter, 153.
"Methods of Nature," 55.
Method and elements of social statics, 256, 267.
— and position of chemistry, 121.
— of physics, 103.
Metaphysical assumptions, 140.
— conceptions, character of, 111.
— explanation of vital force, 138.
Metaphysical method, the, 29.
— (the) predominates in the study of life, 164.
— mystery regarding instinct, 209.
Middle ages, Catholicism in the, 288-299.
Mill and Comte on hypothesis, 105, 110.
Mill on intellectual evolution, 20.
Mill's psychological views, 210.
Modern geometry, 67.
Modern industry, philosophical character of, 311.
Monads, Comte's objection to the doctrine of, 189.
Mulder on the first form of organic life, 156.
— on synthesis, 148.
Muscular action, voluntary and involuntary, 207.

Natural phenomena, the two great classes of, 43.
— religion of the metaphysicians, 239.
Newton's philosophic insight, 86.
Nobler instincts (the) few in number, 222.
Note on the law of evolution, 56.
Nutritive tendency, the, 219.

Observation and experiment, development of, in physics, 98.
— and reasoning, false theory regarding, 227.
— in connection with biology, 174.
Order and progress united by sociology, 252.
Organic and inorganic physics, 43.
— chemistry, definition of, 132.
— substances indefinite in their composition, 151.
Organised substances, first static law of, 145; second law, 152; final law, 157.
Organogens, protein composed of four, 182.

PASSAGE from the inorganic to the organic, 142.
Perfectibility, the two instincts of, 220.
Phenomena of the universe, three stages in the history of the, 26.
— of thought and sensation, 200.
Philosophic character of physiology, 191.
Philosophical anatomy, 180; object of, 188.
— considerations on the mathematical sciences, 58.
— properties of chemistry, 129.
Philosophy, what is it? 18.
Physics, influence and method of, 101.
—, scope and bearing of, 93.
Physiology subordinate to chemistry, 133.
— the basis of psychology, 214.
Political economy, philosophical reflections on, 247.
— future, Comte's views regarding the, 327-338.
— philosophy, analysis of Comte's, 339-345.
Polytheism and fetichism, the ages of, 273.
Positive knowledge based on mathematical analysis, 62.
— morality, the natural conclusion of, 222.
— philosophy embraces five fundamental sciences, 46.
— philosophy can alone reorganise society, 245.
— utility of, 215.
Position and method of chemistry, 121.
Positivism, aim and scope of, 8.
Precision not always certainty, 47.
Prejudices corrected by science, 28.
Preservative instincts, the three, 220.
Protein composed of four organogens, 182.
Proximate principles of organic matter, 181.
Psychological opinions of Mill, 210.
Psychology: a new cerebral theory, 213.

RADICAL inconsistency of the revolutionary doctrine, 238.
Rational mechanics, the problem of, 69.
—, the three fundamental laws of, 72.
Relation of science to art, 165.
Relative or animal life, 199.
Revolutionary philosophy, influence of the, 241.
Romantic attachment of Comte, 6.

SCHELLING'S "Erster Entwurf" plagiarized by Coleridge, 168.
Science correcting prejudices, 28.
— of life, the, 163.
Sciences, classification of the, 40.
Scope and bearing of physics, 93.
— and method of biology, 173.
Sidereal astronomy, our limited knowledge of, 77.
Social doctrine, basis of a new, 5.
— dynamics, study of, 268.
— science founded on no positive basis, 246.
Special and general geometry, 66.
— senses, Comte's criticism on the, 209.
Speculative faculties, analysis of the, 224.
Spherical form, assumption of the, in organic substances, 158.
Spirit of sociology, 249.
Statics and dynamics, 73.
Stationary school, the, 242.
St. Simon's acquaintance with Comte, 3.
Substitute for the term "laws of Nature," 55.
Synthesis and analysis, advantages of, 120.

TELEORGANIC matter, 153.

Theological and metaphysical politics, peculiarities of, 249.
— philosophy, fundamental character of, 102.
Thought and sensation, phenomena of, 200.
Three reigning doctrines, the, 233.
Todd and Bowman on the relation of thought to the nervous system, 202.
Transition age, the, 300.
Two great classes of natural phenomena, 43.

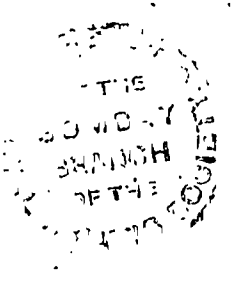
UNIVERSAL form of early organic life, 155.
Utility of hypothesis, 105.

VEGETATIVE and animal life, 177, 190.
Vital dynamics, 190.
Vitality of organic fluids, Comte on the, 183.
Voluntary and involuntary muscular action, 207.

WHAT are the laws of Nature? 51.
What is philosophy? 18.
Will assigned by Galt to the emotional region, 226.
Works published by Comte, 4.

THE END.

LONDON:
WILSON AND OGILVY,
Skinner Street.



00059947

Digitized with financial assistance from the
Government of Maharashtra
on 17 February, 2016